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SOUTHERN RHODESIA

ANNUAL REPORT

of the

DIRECTOR OF RESEARCH

and

SPECIALIST SERVICES

For the Year Ended 30th September, 1953

Presented to the Legislative Assembly

1954

Printed by the Government Printer, Salisbury

1954

C.S.R. 7—1954

G.P. & S. 8460—400—3-3-54.

COMMONWEALTH MYCOLOGICAL INST
31 AUG 1954

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WITH COMPLIMENTS

FROM

THE DIRECTOR OF RESEARCH & SPECIALIST SERVICES.

FEDERAL MINISTRY OF AGRICULTURE.
P.O.Box 25 CAUSEWAY,
SOUTHERN RHODESIA.

ANNUAL REPORT OF THE DIRECTOR OF RESEARCH AND SPECIALIST SERVICES FOR THE YEAR ENDING 30th SEPTEMBER, 1953

INTRODUCTION

Once again the year under review was one of higher than average rainfall. Good early rains were following by drought periods in some areas in December. Heavy and incessant rain fell throughout January and February, causing water-logging in many areas and resulting in the spread of disease and the lowering of crop yields. Grazing, however, remained good and cattle came through the winter in good condition.

The final estimate of European-grown maize is that 2,527,600 bags will be produced from 392,600 acres, giving an average yield of 6.4 bags per acre, which is appreciably lower than last season's average of 7.1. Nevertheless, it is anticipated that the crop will more than meet the country's requirements.

The weather conditions mentioned above resulted in a smaller crop of Virginia-type flue-cured tobacco than was originally forecast. It is pleasing to report, however, that the crop reached the record figure of over 105 million lb., which sold for £17.4 million, compared with 97 million lb. for £14.2 million. There was a decline in the average price from 42.8d. to 39.7d. per lb.

A report on the cattle industry with reference to prices and production methods was submitted during the year. This showed that there was considerable scope for improving existing methods. Only a small increase took place in the total number of cattle slaughtered, and beef supplies were maintained at a high level during the year.

The Dairy Marketing Board was established in October, 1952, and by the end of the season was operating the milk distribution for Salisbury, Gatooma, Que Que and Gwelo and also the only creamery in Bulawayo. The number of producers in the fresh milk trade has more than doubled in the last four years.

Marked interest has been shown by farmers in the work of the research stations which are increasingly able to supply information on the problems of the areas in which they are situated.

It is with great pleasure that I place on record the thanks of the Department to Messrs. Central African Fertilisers, Limited, for the very generous gift of fertilizer. This has been used in experiments at Henderson, Grasslands and Gwebi and has greatly assisted the experiments in progress.

The tsetse and trypanosomiasis situation is still a cause of anxiety, although the position in the Urungwe area had improved by the end of the year under review. Further progress is anticipated from the treating of fly concentration areas at Urungwe with insecticidal smoke from aircraft.

As stated before, the claims of numerous departmental and inter-departmental committees, boards and other official bodies has occupied a considerable amount of the time of senior members of the Department.

AGRO-ECONOMIC SURVEY

The agro-economic survey team, of which mention was made in last year's Report, completed the survey of the unassigned land in the Sebungwe and Zambesi Valley. The report on the agricultural and forestry potentialities of this land was submitted to the Select Committee on Unassigned Land. The Zambesi Valley was found to contain extensive areas of soils which deserve detailed investigation on their suitability for irrigation. The Sebungwe area contains large stretches of very fertile soil in comparison with the general average for the Colony. This soil type, however, is difficult to cultivate with present-day methods, as it is exceedingly sticky when wet. For the rest, these two areas offer only moderate potential production owing to the very broken nature of much of the country, excessively shallow soils of extensive areas and the generally low efficiency of the rainfall.

The necessity for an agro-economic survey of the Colony has been long felt, as reliable information is lacking on the agricultural potentialities of the country as a whole. This information is basic for long-term planning and the development of sound agricultural policy, as well as for the development of suitable permanent

systems of farming for the various ecological regions which differ greatly in their natural factors controlling land-use. The survey was begun in 1950 and is planned to be completed in the coming year.

ANIMAL HUSBANDRY

The year under review was very favourable for livestock production. Rainfall was heavy and well distributed, and grazing remained good and cattle maintained good condition during the dry season. Some farmers experienced difficulty in cultivating and harvesting fodder crops as a result of very heavy rains.

The Cattle Industry

Below are given figures for European-owned livestock over the last five years:—

Year	*Total Number*	*No. of Cows*	*No. of Calves*	*Total Deaths*
1948	1,108,483	329,014	183,751	47,807
1949	1,188,101	350,514	199,439	93,069
1950	1,148,712	332,769	166,572	87,123
1951	1,154,860	328,088	178,088	56,055
1952	1,199,576	348,755	188,815	54,715

A moderate increase was recorded in European-owned cattle at the end of 1952. Breeding cows and calves also increased, and the number of deaths was the lowest for many years.

An intensive study was made of the cattle industry during the year, with particular reference to price fixation and production methods. The result of this study indicated the necessity of bringing price policy into close relationship with production systems. It also revealed that considerable scope exists for improving production methods. It was necessary to emphasize that increased production would depend largely on higher calving rates and the sale of slaughter animals at a younger age. Production methods should also be planned to suit the different ecological areas of the country as well as particular conditions on individual farms. A constructive breeding policy based on a sound foundation for selection of animals would be an important factor towards increasing beef production.

Cattle prices have reached the stage where any further increase may result in under consumption, particularly of the higher grades of beef. This could have a disturbing effect on the efforts of the industry to improve production methods.

Supplies of Slaughter Stock.—The following table indicates the supplies of slaughter stocks and the average cold dressed weight of cattle over the past five years.

Year	*Total Number of Cattle Slaughtered*	*Average Cold Dressed Weight*
1948	173,634	415
1949	174,408	446
1950	200,458	415
1951	234,105	415
1952	238,755	413

A small increase took place in the total number of cattle slaughtered during 1952. No improvement was recorded in the average cold dressed weight of cattle. Beef supplies were maintained at a high level during the year and rationing of beef was only introduced during September. Considerable difficulties were experienced during the year with the sale of choice beef, particularly when frozen.

Prices of Slaughter Stock.—As a result of a further increase in cost of production, higher prices for all grades of beef were introduced and became effective on 12th January, 1953.

MONTHLY PRICES PER HUNDRED POUNDS COLD DRESSED WEIGHT ACCORDING TO GRADE

Month	Rhodesia's Best	Imperial	"A" Grade	G.A.Q.	F.A.Q.	Comp.	Inferior
	s.	s.	s.	s.	s.	s.	s.
January	149	132	110	105	77	67	50
February	149	123	101	92	77	67	50
March	149	117	98	85	77	67	50
April	149	117	93	85	77	67	50
May	149	119	93	85	77	67	50
June	149	121	97	91	77	67	50
July	149	123	101	95	77	67	50
August	149	129	104	98	77	67	50
September	149	134	117	103	77	67	50
October	149	140	122	111	77	67	50
November	149	142	124	120	77	67	50
December	149	145	124	120	77	67	50

Grading of Beef for Local Consumption.—Grading of beef and pigs was carried out at Bulawayo, Salisbury, Fort Victoria, Umtali, Gwelo and Gatooma.

The number of cattle in the various grades and classes was as follows:—

Grade	Oxen	Cows	Bulls	Tollies	Calves	Total
Rhodesian Bred	1,606	25	—	—	—	1,631
Imperial	14,352	261	—	—	—	14,613
Standard A	54,273	1,128	—	—	—	55,401
G.A.Q.	28,920	15,565	—	—	—	44,485
F.A.Q.	10,195	6,765	—	—	—	16,960
Compound	7,185	12,768	2,849	—	—	22,802
Inferior	1,859	5,522	436	—	—	7,817
Tollies	—	—	—	269	—	269
Calves	—	—	—	—	4,233	4,233
TOTAL	118,390	42,034	3,285	269	4,233	168,211

Breeding Stock.—The demand for breeding stock was good and surplus heifers presented no problem during the year.

Stall Feeding of Cattle.—The demand for suitable cattle for stall feeding remained strong and difficulties were experienced in supplying sufficient numbers. The tendency amongst feeders is to demand younger well-grown animals for feeding.

Cattle Slaughter Control Order.—Careful records were kept at the main centres to determine the number of immature male stock and suitable breeding stock slaughtered. A total of 2,159 young immature steers were killed and 778 suitable breeding heifers. This represents less than 2% of the total killed and constitutes no increase on the previous year.

Dairy Stock.—The demand for dairy stock remains well in excess of the supply. A small increase in the number of dairy stock imported was granted by the Union, but is still well below requirements.

Pig Industry

The following tables give the number of pigs owned and slaughtered over the past five years:—

Number of Pigs Owned and Slaughtered, 1948–1952

Year	*Pigs Owned*	*Pigs Slaughtered*
1948	31,001	61,838
1949	37,155	39,155
1950	43,258	54,068
1951	48,987	62,908
1952	64,015	77,968

The pig industry is still expanding rapidly. In order to absorb the surplus in pig products, remunerative export markets are essential.

Grading of Pigs.—A total number of 94,212 pigs were graded at all grading centres divided into the following grades and classes:—

Baconers	*Number*
Grade A	40,853
Grade A2	1,293
Grade B	4,178
Grade C	1,139
Grade X	2,758
TOTAL	50,221

Porkers	*Number*
Grade A	24,224
Grade B	2,059
Grade X	6,228
Inferior	8,164
TOTAL	40,675

Larders	*Number*
Grade A	2,733
Grade X	583
TOTAL	3,316

All grading centres were regularly visited by the Senior Meat Grader to ensure uniform grading in all areas.

As a result of considerable expansion in the pig industry, a substantial amount of pig products became available for export. Difficulties and objections with regard to the quality of pigs exported necessitated considerable changes in the price structure and grading regulations in an endeavour to produce a more uniform article of higher quality. These penalized somewhat the fatter pigs, which are undesirable for export.

New grading regulations which became effective on 15th June, 1953, provided for the following changes:—

1. The compulsory application of all three back fat measurements for baconers.

2. The introduction of a new grade for leaner baconers designated as A2, with a minimum back fat of $\frac{3}{4}$in.
3. New weight limits for baconers and porkers.
4. The introduction of a new grade for porkers.

New Weight Limits for Porkers and Baconers.

Baconers, class I	124—144 lbs.	C.D.W.
Baconers, class II	145—180 lbs.	C.D.W.
Porkers, class A	45—110 lbs.	C.D.W.
Porkers, class B	111—123 lbs.	C.D.W.

The following schedule of grades and prices was introduced during the year:—

Baconers		Porkers		Larders	
Grade	Price per lb. C.D.W.	Grade	Price per lb. C.D.W.	Grade	Price per lb. C.D.W.
	s. d.		s. d.		s. d.
A1	1 8½	A	1 7	A	11
A2	1 7	B	1 6	X	7
B	1 6	X	1 0		
C	1 3	Inferior	7		
X	11				

Sheep

The following table gives the number of sheep owned and slaughtered as well as the mortality in sheep over the past five years:—

Year	*Sheep Owned*	*Slaughtered*	*Deaths*
1948	101,458	51,530	10,608
1949	108,064	48,535	10,592
1950	105,266	38,548	11,415
1951	116,056	49,914	10,247
1952	115,588	54,021	20,698

A strong interest in sheep farming has been evident, but expansion has been slow, and may only become more rapid with intensification of farming methods.

General

Close co-operation was maintained with the Department of Conservation and Extension and Native Agriculture. Numerous ranches and farms were visited in the company of Extension Officers to advise on specific problems of livestock production.

One special conference was held with Extension Officers covering all aspects of dairy production. This course was considered very valuable for exchanging ideas and ensuring the dissemination of uniform advice to farmers. It is gratifying to report that livestock research is now an integral part of the Henderson Research Station programme.

POULTRY

The general trading conditions in the industry showed increased supplies of both eggs and table poultry. Lower prices prevailed during the scarce months, with a maximum of 5s. 6d. per dozen, but as a higher price of 2s. 9d. for surplus eggs was arranged during the flush season, the overall returns to poultry farmers should equal those of 1952. Full requirements of both eggs and poultry were not met and importations were required. Liquid egg to the value of £15,557 was imported to supply bakers' requirements, and table poultry amounted to £5,809.

The Egg Marketing Scheme proposed by the Agricultural Marketing Council reached the stage requiring registration of producers, but owing to objections from smaller producers was withdrawn in March, 1953.

The Rhodesia Poultry Products Co-op., Ltd., at a Special General Meeting on 19th June voted to go into voluntary liquidation, for though financially stable they considered they were a dumping ground for the industry for both eggs and poultry.

The Rhodesia National Farmers' Union arranged with the Bakers' Union to supply liquid and shell eggs at 3s. per dozen, and the Minister therefore arranged for the Cold Storage Commission to act as buyers from producers at 2s. 9d. per

dozen to complete this agreement. It is expected that bakers' requirements for 1954 will almost be met this season. Apart from this flush season buying scheme, both egg and poultry marketing is entirely in the hands of private concerns. Producers still consider a Regulatory Board is required.

Number of Birds and Sale of Produce.—The number of fowls increased by 45,000 and other poultry by 10,000 on 1951. Eggs sold also increased by over 100,000 dozen to 1,556,308 dozen, valued at £258,269, which is the highest yet recorded. Day-old chicks sold numbered 351,900, valued at £29,172, which is somewhat lower than the 1951 figure. Table birds sold amount to 378,280lb., valued at £49,254, and breeding stock sold were 4,771, valued at £4,237. The total value of these products was £340,932.

These figures are the returns from 3,392 poultry producers, but as many suburban producers are not included, they do not represent the whole industry.

Feeds.—Feeds used by poultry were generally available, though imports of protein feeds and wheaten offals were necessary. Antibiotics in feeds for growing table birds became available and are being used to good effect. The production of soyabean meal and more lucerne meal in the Colony would save imports and transports.

New regulations under the Fertilizers, Farm Feeds, Seeds, and Remedies Act were gazetted in Government Notice No. 119 of 13.2.53 and provide for improved control of farm feeds to safeguard the consumer.

Experimental

Gwebi College.—The Thirty-third Annual Southern Rhodesia Egg Laying Test concluded on 31st January, and a full report was published in the *Rhodesia Agricultural Journal*. Results showed improvement in White Leghorns and in mortality rate. A Silver and a Bronze Medal as well as Blue Ribbons were awarded by the South African Poultry Association to successful competitors. The Thirty-fourth Annual Test started on 1st March and has progressed satisfactorily to date. No extension was possible, as the required accommodation could not be undertaken this year.

The Station flocks were maintained and the progeny testing improvement programme continued. The trial of layers in open-air cages was continued for a further year with some alterations found desirable from the experience gained during 1952. Results have been very satisfactory. Fold units on star grass pasture have been introduced and will be used for production trials in 1953-54, in addition to pasture experiments.

Turkey hatching eggs from the United States of America were successful, and small flocks of Beltsville Small White and Broad Breasted Bronze have been established. This stock is a big improvement on the type found in the Colony to-day. The flocks will be increased for later distribution.

Building construction has been curtailed. Two rearing houses have been erected and it is hoped six more will be completed during the financial year. Ten portable folds have been built or purchased. More accommodation is urgently required.

Eggs and table poultry were supplied to the College Hostel and staff and also to the General Hospital. Stud cockerels were sold to farmers. The total revenue was £1,177.

A programme of thirty lectures and practical instruction was given to Junior Students throughout the year. Short courses in practical husbandry were held during the September vacation.

Matopos Research Station.—The programme of improvement and reconstruction of the poultry section here has been delayed due to the ill-health of the Assistant Poultry Officer. Considerable materials have been purchased, however, and building of laying houses has commenced which should be completed this financial year. New stock of Rhode Island Red and Black Australorp has been imported from South Africa for re-stocking.

The office in Bulawayo has been closed and the Assistant Poultry Officer is now resident on the station. All specialist extension services for Matabeleland were carried out from this station.

Henderson Research Station.—The experiment designed to test the possibilities of feeding fresh and dried fingerlings to layers could not be carried through,

as insufficient fingerlings were available for this use. Pullets from 500 chicks now being raised will be used in this experiment in 1954 as sufficient fingerlings from Mazoe Dam have been ensured.

Sabi Valley Research Station.—The laying trials of pullets housed in cages and in wire netting under thatch deep litter houses indicated that the latter housing was preferable and quite suitable for lowveld conditions and can be recommended. Larger number of pullets from 1,000 chicks will be used in more of these pens during the 1954 season.

Cross-bred White Leghorn x Black Australorp pullets proved most suitable, but Black Australorp were also satisfactory.

Improved brooding conditions with infra-red heat lamps were successfully used this winter.

Veterinary

It is pleasing to report the complete control of the Newcastle Disease outbreak which occurred in Bulawayo in September, 1952. The vaccination and control of movement of stock imposed by the Veterinary Department has been effective and the Colony can be considered again free of this disease.

Under the Animal Diseases Act, regulations for the compulsory control of B.W.D. in fowls and turkeys were gazetted in Government Notice No. 949 of 28.11.52.

Veterinary import control has been strictly enforced to prevent the introduction of poultry diseases. Leucosis is probably the most serious disease affecting flocks in the Colony. The efficient services rendered to the Poultry Industry by the Veterinary Department are acknowledged.

General

The deep litter yard system for commercial egg production has become popular and is proving successful. It is likely to reduce costs of production, increase efficiency, and by producing large quantities of valuable compost material fits in well with mixed farming practice.

Extension services of a specialist nature have included visits to farmers, Association meetings, R.N.F.U. meetings, Poultry Clubs, Young Farmers' Clubs, feed manufacturers, Native Agriculture, Conservation and Extension, Land Settlement Board, and Agricultural Research Stations.

Shows.—All Shows were attended by the staff of this branch and judges provided. The Salisbury and District Poultry Club staged a successful show and have funds to double the accommodation of their hall. The Bulawayo and District Poultry Club held the largest poultry show yet staged in Rhodesia at the Royal Agricultural Show and their enterprise is to be commended. These Clubs combined to invite Prof. Gericks, of the Agricultural Research Institute, Pretoria, to judge at their shows, and his visit was much appreciated.

Poultry Improvement.—A plan for Poultry Improvement is under discussion between the Clubs and Department, to set standards for improved breeding and management methods and to safeguard the breeders' and purchasers' interests.

DAIRYING

Dairying Season.—With an average rainfall for the season of approximately 37 inches — about 10 inches above normal — it is not surprising that the heavy precipitation in some areas had an adverse effect on production of milk. The rainfall was fairly persistent in most areas and continued until late in the season, and the period from January to March was deficient in sunshine. Many areas became waterlogged and the production from the cattle suffered.

In spite of the wet conditions, the rank growth of grass and the difficulty in harvesting crops, the trend of increase in production of dairy produce was maintained.

Production of Dairy Produce.—Preliminary conservative estimates of total production of milk in the Colony during the period 1st October, 1952, to 30th September, 1953, indicate an increase of about 500,000 gallons on the production of the previous season, which was itself a record. The pattern of the industry still follows the same trend as in recent years, which is that the increase is mainly

in the output of liquid milk. Butter production is about the same as the previous two years, while cheese production has increased mainly through the manufacture of cheese from the seasonal surplus for the fresh milk market. This trend is indicated in the following table:—

DAIRY PRODUCTION 1945–1953

Year	Butter (1,000 lbs.)	Cheese (1,000 lbs.)	Liquid Milk* (1,000 gallons)	Total Gallons
1945	1,224	702	3,848	7,750,000
1950	900	394	5,720	9,000,000
1951	900	467	6,045	9,505,000
1952	975	490	6,730	10,390,000
1953	950 (*a*)	500 (*a*)	6,960 (*a*)	10,670,000

* Milk available for use as fresh milk, cream and ice-cream.
(*a*) Estimated.

Creameries, Butter Production and Consumption.—There has been no change in the number of Registered Creameries, which remains at five, although two of these made no butter during the season.

Factory butter production during the season 1st October, 1952, to 30th September, 1953, was slightly less than in the previous season, but still exceeds that of the previous two seasons.

The consumption of butter shows an increase over the previous year, and there is no sign as yet of any possibility of reducing the quantity of butter imported to meet the requirements of the Colony.

Exports of butter, mainly to P.E.A., were slightly lower than for the previous year but remain substantially the same at approximately 70,000lb. Considerably more butter was imported than last year, viz., 2,610,156lb., as compared with 1,921,928lb., and this is reflected in the increased consumption and increased stock position at the end of the period.

The only significant change in the butter industry during the season was the introduction of four prices to be paid for butter-fat on 1.1.53, *viz.*:—

	1st Grade Cream PER LB.	*2nd Grade Cream* PER LB.
1st January, 1953 to 31st March, 1953	3s. 0d.	2s. 9d.
1st to 30th April, 1953	3s. 10d.	3s. 7d.
1st May, 1953 to 30th November, 1953	4s. 8d.	4s. 5d.
1st to 31st December, 1953	3s. 10d.	3s. 7d.

Price control was removed from third-grade butter-fat and the butter made therefrom.

The retail prices for 1st and 2nd grade butter remained unchanged at 4s. and 3s. 10d. per lb. respectively until 1.1.53, when the prices were increased to 4s. 2d. and 4s. respectively. These prices remained in force for the rest of the season.

Percentages of first, second and third grade butter manufactured in creameries during the season were approximately the same as last year.

Cheese Factories, Cheese Production and Consumption.—The number of registered cheese factories remained the same as for the previous year, viz., five.

Cheese production during the season reached a total of approximately 566,000lb., as compared with 441,000 for the previous year. This is an increase of 28% on last year, which itself showed an increase of 25% on the previous year. This increase in production is mainly due to increased seasonal surpluses in the fresh milk trade which are used for cheese manufacture.

Imports of cheese amounted to 890,000lb., as compared with 601,300lb. the previous year, while exports increased from 8,500lb. to 74,000lb.

Local consumption, which was about 1,382,000lb., showed a substantial increase on the previous year, which was about 1,035,000lb. This increase in consumption and the increase in exported cheese accounted for the extra local production and increased imports, leaving the stock position at the end of the season substantially the same as that for the previous year.

The quality of locally manufactured cheese was even poorer than the previous season, and much of the poor quality of the cheese can be attributed to lack of facilities at the Dairy Marketing Board's Factory in Salisbury which was called upon to handle large quantities of surplus milk during the flush season.

There have been no changes in cheese prices during the year and these remain at 2s. 5d. and 2s. 9d. for wholesale and retail sales respectively for first grade Cheddar and Gouda Cheese.

The Gazaland Co-op. Cheese Factory at Chipinga, which is the only factory operating outside the subsidized fresh milk Marketing Scheme, had a slightly increased supply of milk this year. The subsidy of 6d. per lb. on cheese made at this factory continued throughout the season, and an extra subsidy of 1d. per lb. was paid for a period to offset the loss shown on the previous year.

Milk and Cream Supplies.—The volume of milk entering the fresh milk trade continues to increase. Supplies were approximately adequate in all areas except Bulawayo, which had an increased demand due to the Rhodes Centenary Exhibition. Supplies were diverted from other centres to alleviate the shortage there as far as possible.

Retail prices for milk remained unaltered during the year, and although the Dairy Marketing Board came into being in place of the Milk Marketing Committee there has been no change in the price structure. Three seasonal prices operated for producers, as in the previous year, viz.:—

1st December to 28th February	2s. 6d. per gallon
1st March to 30th June	3s. 4d. per gallon
1st July to 30th November	3s. 9d. per gallon

All milk continued to be purchased on a quality basis, and the abovementioned prices were those payable for standard milk. The quality premiums and deductions remained the same as before, but the standards for the Methylene Blue tests were increased from March to the legal standards of 3 hours in summer and 4 hours in winter, instead of 2 hours in summer and 3 hours in winter as previously. All sampling and testing of milk for the purposes of this scheme was undertaken by the Dairy Officers of this Branch, over 6,000 samples being taken during the year.

The total gallonage of milk handled under this scheme was approximately 5,700,000, as compared with 5,235,000 gallons during the previous year.

The number of producers supplying fresh milk under this scheme continued to increase.

Milk Recording.—The Milk Recording Scheme continued to operate, but considerable difficulties with staff were encountered during the year. It is very apparent that a revision of the Scheme is overdue, and proposals have been put forward for increased qualified staff so that the Scheme will operate more effectively. An increase in the number of Milk Recorders is also urgently needed, and these have been included in the proposals mentioned above.

It has been suggested that the Scheme should be taken over by the Dairy Marketing Board, but it is considered that it would be premature for this to be done at this stage.

Final figures for the year are not available, but preliminary figures indicate that the figures for this year will not vary significantly from those of the last few years.

General Remarks.—The 1952/53 dairying season has seen a further step forward of the Dairying Industry of the Colony by the establishment of the Dairy Marketing Board on 1st October, 1952. The powers of the Board are much more extensive than those of the Milk Marketing Committee which operated for the previous three years, and it also took over the functions of the Dairy Industry Control Board.

The first major undertaking of the Board was to take over the functions of the Dairymen's Co-op., Ltd., Salisbury, on 1st December, 1952, and since then the Board has been responsible for all milk distribution and manufacture of cheese in Salisbury. On 1st July, 1953, the Board took over the Gatooma Dairymen's Co-op., and on 10th September, 1953, it took over the Rhodesia Co-op. Creameries (1936), Ltd., which had a creamery in Bulawayo and dairies in Gwelo and Que Que. At the end of the season, therefore, the Board was operating the milk distribution for Salisbury, Gatooma, Que Que and Gwelo, and also the only creamery in Bulawayo.

Plans have been prepared and machinery ordered for new dairies at Gwelo and Umtali to be erected by the Dairy Marketing Board, and it is anticipated that these will be in operation early in 1955.

The supply of milk for the fresh milk trade continues to increase and new

producers are entering the fresh milk trade each year. The number of producers supplying fresh milk has more than doubled during the last four years. It is expected that the supply of fresh milk will meet the demand of the European population for the next few years, although it may be necessary for supplies to be diverted at times to meet isolated shortages in some areas. In fact, the Dairy Marketing Board will have to consider the best method of utilization of surplus milk and provide for this in their plans for a new dairy in Salisbury. The present premises in Salisbury are already inadequate, and a new dairy will have to be built within the next few years.

It appears that the production of cheese in the Colony is approximately sufficient to meet half the demand, while butter production will meet less than a third of the requirements of the Colony. There is no immediate prospect of increasing the butter supply, although consideration is being given to the standardization of milk for liquid consumption and using the butter-fat yielded by this method to alleviate the shortage of butter. Cheese production is likely to increase due to the increased supply of milk to the fresh milk trade and the utilization of seasonal surpluses for cheese manufacture.

It is apparent that expansion of the Dairy Industry can be looked for mainly in a greater efficiency in all phases. Milk production on the farms can be increased by better herd management and the use of better bulls. As stated previously in this report, a revision of the Milk Recording Scheme is required, and should the proposals now put forward be accepted, the Milk Recording Scheme will be of far greater value to the industry. A scheme such as is envisaged and the wider use of better bulls through artificial insemination should help farmers to make good use of the cows that they now have and improve the yields of their herds in the future.

FIELD HUSBANDRY

Seasonal Condition.—During the past season almost every station in the Colony registered a higher than average rainfall. The rainy season started early, with good planting rains, and conditions were favourable for crops until January, when heavy and incessant rains fell throughout the month. Rains continued thus into February and early March.

The rains during January, February and early March caused waterlogged conditions in many areas, with the result that crops suffered severely. The heavy and incessant rains favoured the spread of disease, the most notable of which was Helminthosporium in maize and late blight in potatoes.

The Maize Crop

Estimates of Yield.—The final estimate of European-grown crops of maize is that 2,527,600 bags of 200lb. net will be produced from 392,600 acres, which gives an average yield of 6.4 bags per acre. Of this total, Mashonaland is expected to produce 2,279,250 bags from 325,100 acres, giving an average yield of 7.0 bags per acre, compared with a total of 2,170,675 bags from 298,252 acres, giving an average yield of 7.28 bags per acre from the 1951-52 season. This reduced yield per acre can almost certainly be attributed to the excessively wet and prolonged rainy spell, and also to the incidence of Helminthosporium attack.

The four districts of Hartley, Lomagundi, Mazoe and Salisbury are expected to produce 1,700,600 bags of the Mashonaland total, which is slightly less than the production of 1,720,069 bags produced from these four districts during the 1951-52 season.

The estimated yield of 2,527,600 bags is the highest so far reaped in the Colony, the previous highest yield being 2,454,047 bags reaped during the 1951-52 season, but the expected average yield per acre for the whole Colony for the past season is lower than during the 1951-52 season, being 6.4 and 6.80 bags per acre respectively.

It is expected that the past season's crop will supply all the Colony's requirements, and that there will be a surplus to carry over to the following season.

Maize Grading and Moisture Testing.—Owing to the late ending of the rains, samples sent in for moisture test showed a higher moisture content than during the previous season, and samples containing a moisture content of 16 per cent. and over were received as compared to samples having an average moisture content of 12.3 per cent. for the previous season.

Southern Rhodesia Seed Maize Association

The Southern Rhodesia Seed Maize Association and the Government continues to employ two full-time inspectors.

The Seed Maize Association pays two-thirds of the Inspectors' salaries, which amounts to a total of £800 per annum, whereas Government contributes the remaining one-third of the salaries; which amounts to a total of £400 per annum together with a total of £1,050 for travelling expenses, making a total of £1,450 contributed by Government.

Final Report for the Season 1951/52.—In this season there were 3,575 acres planted to maize for seed, which yielded for sale 20,800 bags of 200lb. net, of which nearly 2,000 bags were butts. Members growing 50 acres or less numbered 58, and together they produced less than 5,000 bags for sale, while the remaining 21 members who each grew more than 50 acres sent over 16,000 bags to the Farmers' Co-op., Ltd., for sale.

On the whole, the preparation and bagging of the seed showed much improvement over the previous season; germination tests of the seed were very satisfactory, and were favourable reported on by the Government Seed Analyst.

Sales to the United Kingdom.—For the first time on record 4,396 bags of Southern Rhodesian Hybrid Maize were exported to the United Kingdom. This maize was grown for silage purposes, and was compared with European and American Hybrids. It is very pleasing to be able to report that Southern Rhodesian Hybrid Maize more than held its own with hybrids from other parts of the world, and the results were so satisfactory that an order has been placed for 7,000 bags for planting in 1954. The results of next year's planting will be followed with very great interest, as there is every possibility of a steady and expanding market being built up should these trials again prove successful.

Constitution and Rules.—The Constitution and Rules were revised and brought up to date during the season, and published in booklet form. Recently, a copy of the Minimum Seed Certification Standards for Maize in European and Mediterranean Countries was received from the Food and Agricultural Organization of the United Nations; these standards were based on the International Crop Improvement Association of the United States of America and Canada, but slightly modified for use in Europe and the Mediterranean region, but are in no way inferior to the United States and Canadian Standards. It is worthy of note that the Southern Rhodesian Minimum Standards exceed those of F.A.Q. in nearly every respect, and in no respect are they inferior.

Grain Bags.—At present in this Colony, hybrid maize seed is sold in 200lb. bags, but these are heavy and unwieldy and not suitable for the export market. It has now been decided that maize seed will be marketed in 100lb. bags, with a suitable design and lettering, depicting a hybrid maize ear or field of hybrid maize in attractive colouring.

Hybrid Maize for Natives.—The Department of Native Agriculture has, for the past two years, purchased £10,000 worth of Hybrid seed maize per annum for distribution to native growers. Reports received from the Department are very satisfactory indeed, and very much the same percentage increase in yield over open-pollinated maize has been reported from the Reserves as from European farmers. As the demand for seed by natives has been considerably in excess of the amount which the £10,000 allocated by the Department of Native Agriculture can purchase, the Association has decided for the coming season to market double hybrid seed in 10lb. paper bags sealed with the Association's seal for sales in Native areas.

Interim Report for the Present Season 1952/53.—Although enough seed to sow nearly 4,000 acres was applied for, only 3,113 acres were planted to produce seed for sale. This figure represents 462 acres less than last year. Altogether, 3,538 acres were sown, 258 acres belong to members who do not wish to sell their seed, and 167 acres were disqualified through de-tasselling not being thoroughly done. In spite of the reduction in the seed-producing acreage, most members had a more favourable season, and the quantity available is likely to be more than last year, and should amount to some 22,00 bags of 200lb. net.

New Seed Regulations.—The regulations under the Fertilizers, Farm Feeds, Seed and Remedies Act promulgated during the year include and extend those of the Seed Maize Association. To comply with them it has become necessary to add the words "Standard Grade" and "Treated" to all labels and to give the date of the germination test.

Membership of the Association.—The following table gives a comparison between the 1952-53 season and previous seasons:—

Season	Total Membership	Producing Hybrid Seed	Total Acreage Grown	Seed available for sale in bags of 200 lb.
1948/49	57	40	350	1,774
1949/50	77	65	3,150	13,367
1950/51	91	69	3,275	17,226
1951/52	100	77	3,500	20,000
1952/53	96	80	3,538	22,000 (estimate)

Hybrid Maize Farm.—At present single hybrid seed, which is the seed distributed to members of the Seed Maize Association for the production of double hybrid maize seed, is produced on the Henderson Research Station and on the Gwebi College Farm. This is not a satisfactory arrangement, and efforts are being made to secure a suitable farm for this purpose and so place the production of single hybrid and the bulking of inbred seed on a sound basis.

Grading of Seed.—The seed now being sold for planting the 1953/54 crop is the second which it has been necessary to grade. It is very pleasing to report that grading has resulted in a very marked improvement in the quality of the seed crop.

Seed Maize Prices.—The new seed maize prices were gazetted during the year and the following are the maximum prices chargeable per bag of 200lb.:—

	Per Bag of 200 lb. £ s. d.
Certified Double Hybrid Seed—Large Flats and Medium Flats	5 10 0
Certified Double Hybrid Seed—Large Rounds	3 10 0
Certified Double Hybrid Seed—Small Rounds	3 5 0
Certified Open-Pollinated Seed	4 0 0
Standard Open Pollinated Seed	3 0 0

Summer Wheat Trials

Although the trials conducted during the season 1951-52 can, generally speaking, be considered to have been a failure, one or two crops showed sufficient promise to justify the conducting of further trials in the 1952-53 season. It was decided that larger quantities should be distributed to a smaller number of farmers mainly in the higher rainfall area of Mashonaland, as it was considered that these larger acreages — in one instance 40 acres were sown — would give a very much better indication of the potentialities of the crop, when grown during the summer.

For this purpose, 200 bags of the best three varieties of wheat of the seven which were grown in the previous season were imported from Kenya. Once again the season could not have been more unfavourable for wheat production; if anything, it was worse than the previous season, as heavy and incessant rain continued through January, February and into early March.

Generally speaking, the trial can only be regarded to be again a failure, only in one or two instances were crops reasonably promising.

During the season, a large number of varieties which were obtained from the Matopos Research Station (being varieties bred by the Chief Agriculturist), Angola and elsewhere, were grown on the Agricultural Experiment Station, Salisbury. This can be regarded as the resumption of summer wheat breeding experiments and a large number of selections were made, of which several showed considerable promise.

No wheat has been imported for the coming season, but the 43½ bags remaining over from last year will be distributed to farmers and experiment stations for further trial, at the same time further selection work will be continued to be done on the Agricultural Experiment Station, Salisbury.

Sorghum Production

Sorghum growing continues to make steady if unspectacular progress. The last two good rainy seasons have been very favourable for maize instead of sorghums.

Inquiries have been made, by a firm in the Union of South Africa, about the

availability of sorghum grown in Southern Rhodesia for the preparation of baby foods and breakfast cereals. There is ample sorghum available for this purpose, and it is hoped that a factory will be established in Bulawayo in the near future.

Green Manure Crops

There has been considerable controversy during the past year or so about the relative merits of ley pastures and green manure crops. While recognizing that there is no cash return while the green manure crop is occupying the land, nevertheless, the opinion is held that the greatly increased yields of maize following green manuring fully justify this practice, and that until some better alternative farming practice can be devised, there is no alternative but to continue to recommend a practice which has stood farmers in such good stead over a large number of years.

Miscellaneous Crops

Sunflower.—Interest in this crop appears to have flagged very considerably during the past season; the lack of interest is most probably due to too low a price being offered.

This crop does well in the Colony, is very easily combined and would fit in very well indeed in a rotation with sorghum, dwarf sunflower and Castor bean in the drier areas of the Colony. In spite of the loss of interest, experiments are being continued with the crop.

Dwarf Caster Bean.—Farmers continue to show considerable interest in this crop. At present lack of suitable markets is the main reason why it is not grown on a larger scale. The Matopos Research Station is to begin selection and experiment trials with this crop.

Kenaf (Hibiscus cannabinis).—Owing to the fact that the price of fibres has dropped very considerably, being only about half of what it was a year or two ago, interest in this crop has also flagged. A successful decorticating or ribboning machine has not yet been produced. Experiments continue to be conducted on the various Government Experiment Stations.

Winter Wheat.—Crop estimates are not yet to hand, but it appears that very little more wheat will be grown this year than last year; this is in spite of the fact that every effort, on the part of departmental officials, has been made to encourage farmers to grow wheat. The changing over to growing wheat again will entail a considerable amount of cropping reorganization, but it is confidently expected that there will be a considerable increase over present wheat production, especially by irrigation growers, if the coming rainy season turns out to be a good one.

This Department, in collaboration with the Department of Conservation and Extension, has conducted a number of fertilizer trials in the Charter Group of I.C.A's. These trials have been laid out, firstly to try and get farmers interested in the growing of wheat on moisture-retaining soils, and secondly to try out the effect of new fertilizer recommendations. As at the date of this report, yield figures had not yet been received, but from observations made plots which had received the requisite amount of $P_2O_5K_2O$ and N, with up to 50lb. per acre of the latter, were very much superior to those plots which received the customary dressing of about 100lb. 19% superphosphate per acre.

Southern Rhodesia Potato Association.—Farmers and officials of the Department of Agriculture have, for a considerable time past, realized the necessity for an association for the supply to members and others of sound and reliable seed potatoes under the guarantee of an association in respect of purity, trueness to variety, breed character and germinating capacity.

Consequently, it was decided to form an Association and the Chief Agriculturist was appointed Chairman of a committee for this purpose. It is confidently expected that the first inspections will be made during the summer.

Potato Growing Survey.—The Chief Agriculturist was appointed Chairman of a Committee to go into every aspect of potato production in Southern Rhodesia.

The full report is in the process of preparation, based on information collected by all Extension Officers from farmers, in response to a comprehensive questionnaire.

SALISBURY EXPERIMENT STATION

The rainfall for the season from the 1st October, 1952, to the 30th April, 1953, was 35.47 inches, compared with a mean for the previous 29 seasons of 30.95 inches. It was distributed well over a long growing season, and whilst there were a number of heavy and intense falls, these were not so numerous as in the 1951-52 season. January and the first half of February were characterized by an exceptional amount of overcast and drizzly weather which unfortunately proved extremely favourable for the development of diseases such as Helminthosporium turcium in maize and Late Blight in potatoes. Good planting rains came early in November, so that in general crops were sown earlier than is customary on the Station, and this was no doubt an important contributory factor to the exceptional yields from most crops.

Maize

Yields of maize were high in all trials, a figure of 43 bags to the acre being reached by the top hybrids in the variety trials. These results are extremely encouraging in that they show what can be produced from land which has been sown to arable crops for forty years under an intensive system of mixed farming. Apart from a normal amount of inorganic fertilizers, all manure or compost applied to the plots has been made from the produce of the Station, and the aim has been to maintain all the land at the same fertility level. The opinion has been expressed previously from this station that the growing of as wide a range of crops as possible, together with the use of all the animal manure available to supplement green manuring, will prove superior to any system depending on a narrow rotation such as maize with a green manure crop at fixed intervals. Once again the yield from the variety trials, planted on land on which a very wide rotation is used, averaged approximately 9 bags an acre more than was obtained in a set rotation of maize and velvet beans for green manure alternately.

Variety Trials.—Two variety trials, in which both single and double hybrids were compared with each other and standard open-pollinated varieties for yield, were of a similar design to that used the previous year. Records were taken of stand, tillering, root and stalk lodging, frequency of open tips, height of ear, shelling percentage and ear type and susceptibility to disease.

Yields (*in bags of* 200 *lbs. per acre*)

	Trial No. 1	*Trial No.* 2
Mean of all strains (49)	31·4	35·2
Mean of single hybrid strains	34·7	36·9
Mean of double hybrid strains	31·7	34·7
Mean of open-pollinated varieties	26·2	27·8

Yields ranged from 35.0 to 23.3 bags to the acre in No. 1 trials and from 43.0 to 23.4 bags to the acre in No. 2. As in the previous season, Early Pearl, a variety bred in the Transvaal, proved unsuited to local conditions, and was significantly outyielded by all other strains in both trials.

Nitrogen Trials.—The trials, in which the effect of applications of nitrogen at different stages of the plant's growth is measured, were altered considerably in design. Whilst the six different nitrogen treatments used in previous years were left unaltered, it was decided to test Nitrate of Soda as well as Sulphate of Ammonia. In addition, instead of making basic dressings of phosphates and potash to all plots, these were applied at different levels.

Results fully justified the more complicated layout.

Yields (*in bags of* 200 *lbs. per acre*)

A	*B*	*C*	*D*	*E*	*F*	*Mean*
19·0	25·7	28·1	25·0	27·9	29·0	25·8

Least significant difference=2·3

A=No nitrogen.
B=250 lbs. S/A or N/S at 6 weeks after planting.
C=500 lbs. S/A or N/S at 6 weeks after planting.
D=250 lbs. S/A or N/S at early tasselling.
E=250 lbs. S/A or N/S at 6 weeks + 250 lbs at early tasselling.
F=100 lbs. S/A or N/S at planting + 200 lbs at 6 weeks + 200 lbs. at early tasselling.

The nitrate of soda dressings were calculated to supply the same quantity of nitrogen as the fixed dressings of Sulphate of Ammonia.

The increased yields from the use of nitrogen were both significant and considerably greater than any measured previously on the Station. There were no differences resulting from the use of Sulphate of Ammonia and Nitrate of Soda, but in treatment B and C Sulphate of Ammonia did slightly better, whilst the reverse was the case with treatments D, E and F. There were also significant responses to potash, particularly at the high nitrogen levels. The mean increase from an application of 150lb. of Nitrate of Potash was 3.7 bags to the acre. Phosphates gave no increased yields, either in this trial or in a second where broadcasting was compared with placing the fertilizer in drills 2 inches to the side and 2-3 inches below the seed.

Protein Content of Grain.—An interesting trial was laid down this year to investigate the relationship between the nitrogen in the soil and the protein in the grain with a high and a low yielding variety of maize. There were three nitrogen levels: 0:300:600 of Nitrate of Soda to the acre, and the yields and protein percentage of the grain of Hickory King and Single Hybrid N3-1-4-9 x $A_5$7-6 were compared at each level. The results are given with the reservation that they are for a single season. It appears that this particular hybrid is capable on a soil with a sufficiency of nitrogen of giving increased quantities of grain equally rich in protein to Hickory King. Where the soil is at all deficient in nitrogen, then an increased yield leads to a lower protein percentage. The hybrid strain in question is not genetically of a lower protein content, the supply of nitrogen in the soil is the limiting factor.

Yields (in bags of 200 lb. per acre)

Nitrogen Treatment	Hickory King		N3–1–4–9 x A5–7–6	
	Yield	Protein %	Yield	Protein %
No nitrogen	20·75	8·9	26·01	8·4
300 lbs. N/S	23·09	9·2	27·74	9·0
600 lbs. N/S	25·99	9·8	31·03	10·2
Mean	23·28	9·3	28·26	9·2

Further Investigations into Effects of Green Manure.—With the co-operation of the Chemistry Branch, further investigation into the fundamental effects of green manure were started during the season under review. For this purpose a piece of land which had been under grass for twenty years was chosen. Half the plots are to have a legume ploughed under at intervals; the other half will not. On both, different manurial treatments are randomized. Naturally, after one season only there are no results to report; but where maize was planted as a first crop after grass ley (broken up in April, 1952), there were some interesting yields from the different fertilizer treatments. Outstanding was the effect of 500lb. of Sulphate of Ammonia to the acre, disked into the land a fortnight after the grass had been ploughed up.

Maize after grass with no nitrogen . . . . . = 6·2 bags per acre.
Maize after grass + 500 lbs. S/A . . . . . =18·5 bags per acre.

It is not advocated that maize be planted on virgin land or directly after a grass ley; but where this is necessary, then a dressing of nitrogen is essential.

Other Crops

Soya Beans.—The season was an exceptional one for soya beans, which always thrive in the years of good rains, provided the land has a sufficiency of organic matter. This year the strain and distance planting trial was on land which had been cropped previously to maize, but 10 tons of kraal compost + 200lb. phosphates to the acre were applied shortly before planting the beans. Yields ranged from 7.62 to 11.18 bags per acre, and the closer spacing 2ft. x 3in. again proved superior to 2½ft. x 3in. and 3ft. x 3in. For the second successive year, strain No. 147 gave the highest yields. The young plants were attacked by cutworms.

Velvet Beans.—During the last few seasons the new selections, made with the object of increasing yields of seed, have produced in addition greater quantities of green material for hay. Whilst they are not as late maturing as J 74, 52 and 77, they are by no means as early as Somerset. No. 52 seemed to be more resistant to rust than all the other strains, but J 74 and Somerset were attacked badly. The new strains gave from 11 to 13 bags of seed (200lb.) and up to 3 to 3¼ tons of hay.

Potatoes.—A severe attack of late Blight was experienced and was at its height in January. The early planted crop was well advanced by then, and suffered less damage than the crop from imported seed which arrived late and was planted some weeks later.

None of the varieties sent for trial equalled the Up-to-Date in yield. It was found that seed of the early varieties, dug in April, did not keep well for planting for a main summer crop in October, six months later. This was in agreement with past experience and is one of the reasons why Up-to-Date has maintained its popularity in this country. Internal rust affected a high proportion of tubers in some varieties. These trials will continue, but so far the supremacy of Up-to-Date appears to be as marked as it was in previous variety trials.

Fibre Crops.—Three strains of Kenaf were compared for yields of fibre at three different spacings: 18in. x 3in., 12in. x 3in. and 6in. x 3in. As was anticipated from small trial plantings the previous year, Cuban kenaf produced greater quantities of fibre than either the Brazilian strain (Hibiscus kitaibalifolius), or the Egyptian (Hibiscus cannabinus). Samples of each strain were cut eighteen weeks after planting and retted. From the percentage fibre obtained it is calculated that the Cuban kenaf was yielding slightly over a ton of fibre to the acre. There was no significant difference in yields from the different spacings.

Wheat.—In line with further investigations throughout the Colony into the possibilities of growing summer wheat, a large number of varieties from various sources were collected and sown in mid-December. Very wide differences in resistance to rust and yields were apparent. For such a wet season, some varieties showed great promise, whilst many others grew so poorly that it has been possible to discard them. These trials will continue.

Other Activities.—The Station has continued to store and distribute the single hybrid maize seed produced by the Department for issue to members of the Southern Rhodesia Seed Maize Association. It also distributed, on behalf of the Food Production Committee, the seed wheat obtained from Kenya. There was no noticeable reduction in the number of applicants for seed and planting material of old and improved varieties of a wide range of crops. The staff of the station judged the maize and produce classes at the Gatooma and Sinoia Agricultural Shows.

General

Conferences.—The congress of the South African Society for the advancement of science was held in Bulawayo this year and was attended by the Chief Agriculturist, as well as by other members of the Department of Research and Specialist Services.

Very interesting papers were read, and the discussion which followed the papers helped to clear a lot of misunderstanding between extreme protagonist of ley farming and green manuring.

The Chief Agriculturist, together with the Chief Botanist and Plant Pathologist, attended the Second Annual Hybrid Maize Conference at Pretoria and presented a paper entitled "Hybrid Maize Breeding and Production in Southern Rhodesia". One of the results of the Conference was the decision to exchange material whereby Southern Rhodesia will test a large number of South African inbred, hybrid and open pollinated lines and varieties for susceptibility or resistance to Puccinia polysori, and the Natal Agricultural Research Institute will test out Southern Rhodesian inbred, hybrid and open pollinated lines and varieties for susceptibility to or resistance to Helminthosporium attack.

An extensive tour of the Charter Group of I.C.A's was made during April and May, culminating in a meeting of the various I.C.A. Committees at which recommendations were accepted for the development of a sound farming system for this area.

Agricultural Shows.—The Chief Agriculturist judged the Maize, Agricultural Produce and District Exhibit sections at the Royal Show held at Bulawayo this year, and also at the Salisbury, Gwelo, Umtali and Bindura Shows. It is pleasing to note that on the whole all sections were of a higher standard than in previous years.

HORTICULTURE

This has been a mixed year for horticulture. Disease, as the result of the continued rain and overcast skies in summer, and severe and prolonged frost in

winter, caused very serious losses in vegetable crops. Conversely, the good rains were of great benefit to sub-tropical fruit trees, while deciduous trees benefited from the frosts.

There were larger demands for fruit and vegetables for processing at Umtali, and exports of the products to the United Kingdom were well received.

More experienced growers are entering the industry, and a higher standard of production has resulted.

Citrus

Good crops of all citrus fruits were obtained and quality was better than for some years. Demands for fruit were excellent except during the frosts. Larger quantities of naartjies were required, and there was a very extended orange season. There was a continued shortage of nursery trees.

Citrus Sales.—Declared sales of citrus for 1951-52 (including fruit used for processing) were as follows (cases of 75-85lb.):—

Oranges	250,961
Lemons	5,330
Grape Fruit	2,725
Other	3,675
TOTAL	262,691

This is an increase of 59,067 cases and the first for four years, due to better rains. The fruit was valued at £231,000.

Citrus Trees.—For the year 1951-52 the number of citrus trees growing in the Colony totalled 214,503, of which 143,653 were bearing trees. This is an increase of 3,782 trees over the previous year.

Citrus Fruit Imports.—These amounted to 1,040,659lb., valued at £7,314, and were slightly less than in 1951.

Deciduous Fruit

There was a continued improvement in the handling and presentation of deciduous fruit. Some consignments marketed compared favourable in quality, appearance and packing with the best imported from South Africa. Prices for apples were good and well maintained. Heavy early rains spoilt the flavour of early peaches. Peach mildew disease was common. An apple crop was wiped out by hail in N. Umtali.

After several years' experiments, a completely new system of pruning of young trees had been successfully worked out. This is based on summer treatment, and it is hoped to publish a report on the subject later.

Much interest was shown in grape growing, and several commercial plantings were made.

Deciduous Fruit Trees.—For the year 1952 there were 159,976 deciduous fruit trees growing in the Colony. This is a drop of 12,412 due to the abandonment of a large commercial planting of non-bearing trees.

Deciduous Fruit Imports.—For 1952, imports of apples, pears, plums, peaches and apricots totalled 3,553,895lb., valued at £90,229 (1951, £75,398). This is a considerable increase which local supply is unable to meet.

Grapes and miscellaneous fruit imports were 822,762lb., valued at £22,097.

Sub-Tropical Fruit

The severe winter frosts did much damage to new plantings of sub-tropical fruit trees. More interest was shown in pineapple planting and bananas.

Trees.—For 1951-52 the number of sub-tropical fruit trees in the Colony totalled 74,163. It is difficult to account for the decrease of 2,330 trees.

Sub-Tropical Fruit Imported (Citrus excluded).—Imports of this fruit amounted to 6,689,237lb., with a value of £48,487 (1951, £46,267). Far more of this fruit could be home grown.

Vegetables

A great scarcity of vegetables occurred right through the rains due to excess humidity and lack of sun. Diseases wiped out cabbage crops completely, and

growers suffered considered loss of income. Supplies improved during the dry season.

The recorded acreage for 1952 of the large vegetable producers was 3,118 (1951, 2,984).

The imports of fresh vegetables showed a welcome reduction in 1952 and amounted to 2,120 tons, valued at £40,150, compared with £46,736 in 1951.

Onions.—The acreage under this crop continues to decline and only 217 acres were planted, which is the lowest since 1947. The yield was 10,853 bags (120lb.).

General

Nursery Planting Material.—For 1952 the imports totalled £25,081 (1951 £23,077).

Cut flower imports were valued at £8,533.

Registered nurseries total 41, being a continued increase. There is need for a larger number of the shrubs and trees to be propagated here rather than local nurseries being so dependant on Union supplies.

Fruit and Vegetable Production and Marketing Inquiry.—Some action has been taken on the Agricultural Marketing Council's report on fruit and vegetable production and marketing.

Seed Production.—Some progress is reported on the production of seed, in particular of lettuce, peas and beans.

Advisory Work.—The demands for horticultural services and advice have steadily increased, resulting of necessity in curtailing the preparation and publication of technical articles.

Thirteen lectures and/or demonstrations were given at various centres. Judging of fruit and vegetables was carried out at the Chipinga, Umtali, Bindura, Sinoia, Salisbury, Gwelo and Bulawayo Agricultural Shows and at five Flower Shows. Assistance in judging district exhibits at Sinoia, Gwelo and Bulawayo was also given.

Rhodes Inyanga Orchards

Good progress was made at Rhodes Inyanga Orchards and intensification of the recording work was possible. The total rainfall was 67.48 inches. A grass temperature of 17° F. was recorded.

Fruit Crop and Sales.—An excellent blossoming of apples gave promise of a really bumper crop. The peak of the flowering period, however, coincided with high temperatures and very drying winds, and these severely affected pollination and the set of fruits. A total of 1,077 bushels of apples were sold (last year 1,500 bushels) plus windfalls and culls. Sales totalled £1,491.

D.N.O.C. Apple Tree Spraying.—The experiments with the use of the dinitro-ortho-cresol oil spray (D.N.O.C.) were continued. A most marked effect in more regular bud burst and foliation was clearly seen in the sprayed blocks. Trees sprayed last year still showed a response to the spray.

Disease and Pre-harvest Sprays.—The experimental work in connection with fruit diseases and apple drop spraying had to be abandoned owing to persistent rains upsetting the spraying programme.

Recording Work.—Blossom recording work was continued with apples and pears so that a chart can be prepared. Crop recording of all bearing trees was also commenced. Average yields of the ten best apple trees of the commercial varieties are as follows, expressed in bushels of 40lb.:—

Variety	*Bushels*	*Lbs.*
White Winter Pearmain	2	20
Rhodes Island Creening	5	12
Chinimuri	5	16
Delicious	3	19
Versfeld's	5	14

While these leading figures appear most impressive, it has to be remembered that some of the trees are biennial in bearing. A four-year average will give a truer picture.

Cider Apples.—The trees grafted to cider apple varieties from England have made good growth and look promising.

Variety Trials.—A new planting of 270 trees of pears, apricots and nectarines was made. They consist of several varieties and root stocks for trial and comparison.

An interesting Versfeld's apple sport has been located in the orchards which ripens six weeks earlier than the normal and is of economic significance.

General.—A marked increase in deficiency disease has been observed and foliage application spraying experiments are to be carried out.

Further trials were carried out to find a satisfactory legume for summer cover cropping of orchards. Clovers showed some promise.

The nursery was extended and an improved contour layout adopted. Much damage was done to young orchard replants by insects eating out young buds. Attempts to control orchard invasion of kikuyu grass by nitrogen application and heavy sawdust mulching is to be done after the first good rain.

Five acres of potatoes were grown for seed. Late blight disease was so severe that the yield was only slightly more than the seed planted. The tubers were mostly walnut size and smaller.

GWEBI COLLEGE OF AGRICULTURE

Education

Three courses of students have now passed out from the College. Very pleasing reports have been received from farmers on the ability and quality of some of these young men. There is plenty of scope for Gwebi-trained men in the sphere of farming; in fact, it is not possible to fill all the vacancies for farm assistants which are brought to the notice of the College.

The equipment of a Science Laboratory has given realism to the teaching of the basic sciences of agriculture.

The number of lectures given during the College Year was: Junior Course, 435; Senior Course, 465. All Students devoted three days a week to practical work, one in the field, one with livestock and one at mechanical or building work. Week-end duties with livestock, at tractor servicing and in the poultry section continued.

The policy of holding demonstrations on the College Farm continued and will be developed further in the future. The Senior Students made nine day visits to other farms and the Juniors three visits. The Senior Students carried out a week's tour of farms in the Glendale, Umvukwes, North Maguadsi, Banket and Trelawney areas.

The various trophies continued to provide a useful stimulus to good work in the various subjects. The results of the Senior final examinations were disappointing this year, but the Junior Course produced the highest standard of results yet achieved in First Year final examinations.

A foundation Student has been awarded the National Diploma in Agricultural Engineering in England; he was excused qualifying examinations in view of his Gwebi Diploma. Another Student who went on to Natal University and where he has been granted a concession in time, in view of his Gwebi Diploma, is reported as doing very well in his studies for a degree in agriculture.

The re-orientation of the Course in Agricultural Engineering to emphasize that it is a science that deals with soil and its relation to implements used on it and in it, and the crops that come out of it, as well as modern building to house implements, crops and animals, has been the basic idea incorporated in lectures throughout the year.

Lack of fundamental knowledge, especially in relation to pastures on the College Farm, is a serious stumbling block to both the teaching of pasture management and the demonstration in practice of sound farming systems. The Lecturer responsible for the teaching of pasture management is, therefore, devoting as much time as possible to research.

Development

The Public Works Department are now proceeding with plans for the provision of the necessary accommodation for twelve additional Students in October,

1954, and a further twelve in October, 1955. The complement of the College will then be seventy-two Students.

The projected field developments reported last year have now been carried out. First impressions are that they will prove most beneficial. It only remains to stock Acton Meadow to complete the whole plan of the development of the College Farm which has been worked out by the Staff team. The control of erosion afforded by the new field layouts on Broadbalk, Lilford, Nyasaland, Huggins and Kopjeland field is gratifying. Further work on conservation of arable land will largely devolve upon soil conserving agricultural practices.

The development of planted pastures for the grazing of the dairy herd, and incorporating the fertilization of the pasture through folding poultry on them, has commenced.

Further steps towards the complete mechanization of the College Farm have been taken. At the same time the question of demonstrating the use of ox-traction to Students is not being forgotten.

Buildings constructed departmentally include a new Staff Quarters, bulk grain storage, new piggeries, poultry section buildings, tank stands and water troughs.

A landmark in development is the putting into operation of a small overhead irrigation project which will mean much to the livestock herds and is vitally important, for demonstration of technique to Students.

The Science Laboratory has been adequately equipped and will now play an important role in education and research.

The pedigree section of the Friesland herd has been strengthened by the purchase of two pedigree heifers in calf.

The playing fields have been extended and brought to a better state of usefulness.

The post of Vice-Principal has been established and filled.

A College Stand was again provided at the Salisbury Show and, for the first time, the exhibit was sent to the Bulawayo Show, where it is understood great interest was shown in the activities of the College.

A small start has been made in the provision of a tarmac surface for the roads in the residential and farmstead areas. It is vital that funds be provided for the completion of this work, which is so essential for the health of the community here.

Production

The season was the wettest recorded since the College opened in early 1950. The seasonal total was 39.55 inches, compared with the forty-year normal of 31.96 inches. The season started early, planting rains falling in mid-October and continuing favourably until mid-December; thereafter rainfall was continuous and all late planted crops, particularly legumes for hay and the field experiments, suffered.

Details of field production are:—

Crop	Acre	Production	Yield per Acre
Maize grain, Double hybrid	241·00	3,112·0 bags	12·9 bags
Maize grain, Hickory King	20·19	178·8 bags	8·9 bags
Maize silage	27·00	253·8 tons	9·4 tons
Sunflower seed	3·00	13·8 bags	4·6 bags
Sunflower whole heads	16·00	4·12 tons	578·0 lbs.
Groundnuts, in shell	19·00	163·5 bags	8·6 bags
Oats, seed	14·00	12·6 bags	0·9 bags
Sunnhemp, seed	3·00	nil	—
Potatoes, table	6·00	459·00 bags	77·0 bags
Velvet beans, seed	3·00	36·00 bags	12·0 bags
Cowpea, seed	3·00	5·23 bags	1·7 bags
Soya beans, seed	3·00	22·00 bags	7·3 bags
Legume hay	101·00	90·00 tons	0·9 tons
Legume grazing	22·00	—	—
Maize breeding	45·00	—	—
Planted pasture	44·00	—	—
Fallow	113·00	—	—
Green Manure	199·00	—	—
Wheat (experiments)	2·00	3·48 bags	1·7 bags
Cotton (experiments)	0·4	95·00 lbs.	239·0 lbs.
TOTAL ACREAGE: 891·5			

Note.—Lilford Field (106 acres) yielded 17.4 bags/acre following green manure, whilst Nyasaland, being second-year maize, yielded 8.5. This is the last time, with present cropping plans, that second-year maize will be grown.

Grass	Acres	Production	Yield per Acre
		tons	*tons*
Hay, veld	42	40	1·0
Silage: Napier	14·5	90	6·2
Veld grass	65	100	1·5

25,114 gallons of milk were produced. Production is increasing as more animals come into their second lactation. Butter fat remains at a satisfactory level, whilst, following an improvement in technique, the methylene blue test has been maintained at over five hours. Twenty cattle and eight Friesland bull calves (veal) were sold. Sales of pigs were thirty-six breeding stock, ninety porkers, four baconers and six larders. Fifty-two sheep were sold as mutton. The poultry section produced 6,000 dozen eggs, 2,000lb. of table poultry and 3,000 chicks were hatched, including 1,800 day-old chicks for the Sabi, Henderson and Veterinary Research Stations.

The thirty-acre Eucalypt plantation is being clear felled and the timber sold. It is hoped that improved management, with the advice of the Department of Forestry, will result in useful re-growth leading to profitable production.

Research

Limited progress has again been made in various spheres. Research in the early days of development of the College has been mainly *ad hoc* in nature. Now that the proper organization of the educational and practical farming aspects of the activities of the College has been achieved, it is important that the proper organization of the research programme should now receive more attention. The limitations of Staff and equipment continue to prevent the efficient conduct of a programme of field experiments, particularly in view of the priority treatment given to hybrid maize breeding. The Animal Husbandry Section has an adequate establishment for the conduct of feeding trials, but awaiting completion of satisfactory pens in which to carry out feeding trials with cattle and pigs. The Engineering Section has done some useful investigations, but here again there are limitations of Staff and equipment. Useful pilot information has been obtained in the study of pastures on heavy soils, though the officer responsible for this work requires assistance and improved facilities if he is to develop this important work properly. An interesting recent development is that certain analyses can now be made in the College Laboratory. In view of the importance of the matter, to both Staff and Students, it is intended to make a special report on the subject of development of research at Gwebi, in the near future.

The following notes describe, very briefly, some of the present research projects and progress made.

The question of phosphate supply to crops is very much to the fore at the present time. The soils derived from banded ironstone which occur on the College Farm are of specific interest in this connection, because of the possibility of rapid fixation of phosphates. Although recent experiments on Broadbalk have not reflected any increased yield with phosphate, in this year's experiment on Munday field, all methods of phosphate application gave significant increases in yield over no phosphate. The main point of practical interest is the justification, up to the present, of the College policy of localizing approximately 100lb./acre of a phosphatic fertilizer for maize, rather than broadcasting the normally accepted dressing of 200lb./acre after ploughing. Where phosphate was ploughed in a significant increase of one bag per acre was obtained, but there are economic and practical difficulties to solve should further experiments indicate that such a policy is worthwhile.

The experiment to investigate various rates of compost application in relation to green manuring has been concluded. The main conclusion is that provided maize planting is done early and with a good stand and provided rainfall is not deficient, good yields will result under average conditions irrespective of *small* differences in manurial treatments such as phosphate and compost application and frequency of green manuring.

Salisbury Experiment Station Reports have indicated an increase of 5 bags/acre when using Double Hybrid Maize compared with Hickory King. To those

farmers who mistrust the results from so-called "small plot" (albeit critically designed experiments), it should be of interest that large-scale field trials on Broadbalk, covering 35 acres, gave exactly the same difference — 5 bags per acre in favour of Double Hybrid (N3 x A5 x M9 x T4) compared with Hickory King.

Progress was made in the study of field scale application of hormone sprays for weed control.

Progress has been made in the attempt to postulate a relation between growth of veld and the storage of food reserves in indigenous veld grasses; this information, when available, will be of immense value in designing systems of management.

The carrying capacity trial, on indigenous veld, has been concluded, pending conversion to a fertilizer-grazing trial. Over the period of three seasons the stocking rate applied appeared to have little influence on gain/animal, but the marked differences in gain/acre indicated the importance of this aspect. Marked responses to 400lb. sulphate of ammonia/acre were obtained in a seasonal clipping and growth experiment. In another experiment the unchecked seasonal growth of three species of veld grass was studied, whilst a fertilizer experiment on natural veld demonstrated the importance of phosphate and to a lesser extent potash where fairly large quantities of nitrogen were applied.

Time and motion studies of animal behaviour, carried out by the Engineering Section, have produced valuable information for use in designing farm buildings. A new approach has been made to the mechanical handling and storage of grains, up to the stage where the final product is to be fed to poultry. A full report of this work is in preparation. Work on glue failures is in progress in connection with the construction of farm buildings from plywood. Other investigations and developments concerned weed spraying, an adjustable tractor hitch, a farm method of joining two 2-row planters to form an articulating 4-row planter, and the losses in the drawbar horse-power of tractors.

A pilot experiment with the dairy herd aimed at investigating the value of indigenous veld in milk production whilst the value of grazing cattle on a legume till the end of May was demonstrated. Data was collected from cows giving over 3 gallons a day, milked three times daily.

College Council

The College Council, Mr. D. C. Lilford (Chairman), Lord Acton, Major H. G. Mundy, Mr. G. R. A. Johnson, Mr. H. H. Cole and the Principal *(ex officio)* continued to take an active interest in College affairs.

HENDERSON RESEARCH STATION

General Farming Conditions.—The season 1952-53 started with good early rains which stopped in mid-November and were followed by a severe six weeks' drought. This did much damage to the newly planted maize, and about one-third of the crop had to be replanted. From the beginning of January rains continued steadily without more than a few days' break until mid-April. Waterlogging damaged crops in some lands.

Research in Systems of Farming

The work of developing systems of permanent farming for the food-producing areas has continued. It comprised the exploration of systems of ley farming in experimental units up to 300 acres in size. These systems of farming are being supported by experiments on soils, pastures, animals and crops.

Nine-year Rotation with Silage Leys.—The nine-year rotation is now in full swing, and will be used in the coming year for a milk herd. The cropping sequence is provisionally Napier/legume silage ley for four years, followed by a legume mixed with sunflower for pod and seed concentrate meal, then maize twice, then legume, then maize and back to ley. The indications are, however, that it may be desirable to make up the rotation in the proportions 40% ley, 40% maize and 20% forage legume concentrate. In a ten-year rotation, this would mean two sections under legume, four under maize and four under ley. This meets more nearly the need for grain, and a usable balance between the constituents of the bulk and other forages produced.

Consideration is also being given to the desirability of modifying the rotation further from a 9-year to a 5-year cycle, in which the sequence is Napier for 2 years, followed by maize, then by legume, and then by maize again underplanted with the Napier ley. This would preserve the 4 grass; 4 maize; 2 legume ration. Evidence also points towards the likelihood that Napier and legumes, properly managed, can restore the workability of the soil in the short space of 2½ years. Such a short duration ley would also lend itself to very close planting of the ley, instead of in to-day's widely spaced rows.

Heavily Fertilized Rotation with Silage Leys.—The heavily fertilized Napier grass rotation is fully established and the silage made will be used for a study of forage utilization during the coming winter.

Summer Grazing and Hay Ley Rotations.—While attention has been centred in the initial stages on silage ley rotations, some 40 acres of temporary leys for grazing and hay have been established for a study of management, use and productivity. On the sandveld area of this Station two additional rotations, one including a grazing ley using Star grass, and the other a silage ley using Napier, have been started in collaboration with the Conservation Research Branch. Different types of contour ridges, spillways and stormwater diversion banks have been constructed with a view to studying their suitability for ley farming as well as their effectiveness in flood control.

Dry Winter Grazing Leys.—On the Estate Food Production section, a more extensive form of ley farming has been started in which Rhodes Grass, Napier, Kazungula Setaria, Panicum grasses are sown or planted with legumes in rows and only grazed by cattle in winter and not cut at all during the summer. It is likely that the legumes will volunteer and reseed themselves with a minimum of encouragement by cultivation in early spring, and that the soil improvement under grass thus treated will be rapid. The costs of such management are small, and the winter grazing from these grasses has already shown itself to be unexpectedly good.

General Conclusions for Units

Protein Production.—In the balancing of crops, animals and pastures in permanent systems of agriculture, it seems that leys tend to produce excessively large amounts of forage, and even when good ensilage is made, it is difficulty to produce enough protein rich feeds in the rotation to furnish a balance ration in winter. This characteristic difficulty can be met by any one or any combination of the following alternatives:—

(i) The use of nitrogenous and other fertilizers which can improve the protein status of the herbage.

(ii) The use of legumes in the leys, both to improve the protein content of the herbage and to reduce the amount of nitrogenous fertilizers needed.

(iii) The improvement of methods of hay making and the use of economical methods of grass drying.

(iv) The growing of improved annual protein rich forage crops.

(v) The choice of a form of animal husbandry best adapted to a nutritional environment which suffers minor shortages in winter.

(vi) The use of irrigated winter pastures.

Yields.—The Napier and legume mixtures on the units yielded upwards of 20 tons of silage and 50 autumn grazing days per acre, with the aid of normal applications of fertilizers (200lb. rock and superphosphate and 250lb. sulphate of ammonia per acre). The harsh and cloddy clay-silt loams are responding well to these grasses and breaking down into friable soil filled with large amounts of grass roots. It has been found that the perennial grasses, Napier, Star, Kavirondo Sorghum, Kazangula, Setaria and Rhodes can combine with annual and perennial legumes to make massively productive forage mixtures.

Pasture Research

Nursery Work.—Promising legumes include Crotalaria intermedia, C. paulina, Pigeon pea, Vigna vexillata, V. parniflora, Dolichos lablab, Mauritius Bean, Teramnus uncinatus, Desmodium discolor, D tortuosum and Glycine javanica.

These are now being grown in irrigated beds for seed production in areas up to an acre in size. Crotalaria intermedia has been planted on a field scale on 16 acres of Napier for silage. Its protein content at the flowering stage was 24%.

The protein content of the Napier silage on the 9-year rotation varied around an average of 8% in the dry basis. Taking a protein digestibility figure of 50%, this implies that 100lb. of this silage can be expected to contain .8 to 1lb. of digestible protein.

Production Studies with Napier.—Comparing the yielding capacity of Napier Fodder with that of pastures overseas, the best New Zealand pastures yield 8,900lb. of total digestible nutrients per acre, whereas heavily fertilized Napier on this Station is giving a recorded yield of 8,100lb.

Crude protein yields have been raised from 244lb. per acre without fertilizers to 2,130lb. from Napier with the use of nitrogenous and phosphatic fertilizers. In New Zealand, the best Rye grass and clover pasture yields 3,500lb. of crude protein per acre, and the average figure given by Davies for an English ley is 820lb. per acre. No significant increases in yield have as yet been obtained through various forms of cultivation treatment, nor through the admixture of legumes nor by the use of lime.

There is therefore reason for some optimism that Southern Rhodesian leys will be as productive as in other countries, hitherto considered to be more favourably situated in respect of climate and soil.

Winter Pastures.—7½ acres of various mixtures of exotic grass and legumes such as Ryegrass, Phalaris, Cocksfoot, White and Red Clovers were established and made good growth with the aid of ¾-ton lime, 400lb. phosphates and 3 dressings of 100lb. sulphate of ammonia per acre.

In comparison with these, lucerne and Napier were both tried alongside. The response to the lucerne on this particular soil to ¾-ton of lime per acre was good. The Napier planted densely in 2ft. rows grew more luxuriantly than any others and shows promise as an irrigated pasture for the late autumn and early spring. Current experiments show that heavy fertilization will be necessary to maintain production from Napier fodder so closely spaced.

Grass Drying.—A barn hay drier, costing about £60 to install in two flue-barns, has proved capable of curing one ton of good hay daily through summer, regardless of weather conditions, and without the use of heat, at a cost of 5s. per ton. This is important for the development of ley rotations and the production of high protein hay from perennials, the cutting of which so often coincides with wet weather.

Comparison of Protein Yields from Various Annual Forage Crops.—Approaching the ley rotations from another angle, the Agriculturist has initiated a comparison of different annual forage crops for the production of protein rich, bulk and concentrate supplements to the perennial herbage.

A limited amount of annual forages can be grown in the ley rotations, but it is obviously desirable to keep this down to a minimum in order to ensure a surplus of grain for sale to industry and urban centres.

Animal Husbandry

Experiments on the Utilization of Forages Yielded by Units.—Much skill is required in the feeding of "all roughage" feeds to cattle through winter. 3½-year-old steers consumed up to 60lb. of silage daily, but preferred an admixture of tall, uncut green Napier, even in August. Milk cows readily eat 80lb. and more of this silage. No scouring was observed throughout this winter's feeding period.

In order to ascertain how best to convert the forages available from ley rotations into saleable livestock products, various combinations of bulk forages and concentrate feeds are being fed to different classes of livestock. Adequate summer grazing can be obtained from veld or from planted pastures such as Rhodes grass, Panicum Makarikari, Star Grass, and others, and at this early stage, the majority of the work is concentrated on the achievement of cheap and productive winter rations.

Winter Fattening.—Winter fattening of 3½-year-old steers was explored with five groups of 10 Hereford grade steers averaging 1,000lb. in weight. One group was slaughtered at the time of purchase in order to have carcase determination figures for comparison with other groups after fattening.

The next group of 10 steers gained 200lb. of liveweight in 100 days of feeding of these roughages when supplemented by 800lb. of beef fattening meal each.

Another group put on a similar gain in 150 days of feeding of these roughages with only 600lb. of beef fattening meal as a supplement.

Napier silage, 5lb. of bean hay and stover alone were fed to the fourth group of 10 steers, and these gained ½lb. daily until the green grass was available in the vleis. There is every reason to suppose that this group will fatten easily before Christmas and that the amount of concentrates will be appreciably less than 400lb. per steer.

Napier silage and stover proved capable, without bean hay, to maintain weights of 1,000lb. 3½-year-old steers, and this fifth group of 10 has been transferred to vlei grazing to ascertain the amounts of concentrate supplement necessary to fatten them before the end of the year.

This work on 3½-year-old feeder steers will be repeated next year, giving greater attention to the use of bulk forages.

Breeding Experiments.—Breeding herds of Aberdeen Angus, Africander and Friesland cattle are being kept, and calving policy and supplementary feeding requirements are being studied, in relation to fecundity, growth, and, in the case of the Friesland, milk production.

Weaner Steers.—The rearing and fattening of weaner steers may offer a profitable means of converting the ley forage into meat, and a series of 11 groups of ten weaners each are now on treatment. Diets vary from exclusively roughage feeds to the feeding of carbohydrate concentrates, or protein rich concentrates as supplements in winter alone or throughout winter and summer.

Acknowledgement.—The Station is indebted to the Cold Storage Commission for having seconded an Animal Husbandry Officer to carry out this animal research work which is being planned with the co-operations of a livestock Liaison Committee of farmers and research officers.

Field Husbandry

Inbreds Grown for the Production of Single Cross Hybrid Maize.—During the season 1952-53 a total of 75 acres was put down to the production of single cross hybrid maize with 80 acres of green manure for the 1953-54 season's hybrid crop. Of the 75 acres, 55 acres were devoted to cross N3 x A5, which yielded a total of 200 bags at an average of 3.8 bags per acre. Twenty acres of land was planted to cross M9 x T4, which only gave a yield of 2 bags per acre. This was due to the low rainfall during planting, the poor state of fertility of the land and the very poor germination of the seed.

The revenue earned by the 1952-53 hybrid maize crop was £3,000.

The estimated increase in yield on the commercial maize crop in Southern Rhodesia is 25%. It can therefore be appreciated that the hybrid maize work done on Henderson constitutes a valuable service to the farming community and to Southern Rhodesia.

Irrigation.—At the beginning of the season a permanent pumping system was installed on land No. 3 to provide irrigation water. The irrigation furrows on land 3 have been repaired during the year, and sumps have been built for the purpose of overhead irrigation.

Experimental Work.—During the 1952-53 season critical research work was carried out on maize fertilizer experiments on contact and Tatagura soils, chemical weedkiller experiment on Summer Wheat, and a cotton fertilizer experiment and Hibiscus fibre trial; the latter two were scrapped because of unfavourable weather conditions during November and December.

Phosphate and Green Manure Trial (32 plots).—A rotation designed by the Chemical Branch on the effects of Phosphates, potash, lime and Nitrogen on Maize in a Green Manure rotation, gave no significant response to Phosphate or Potash. A small response to lime and a highly significant response to Nitrogen were recorded. No interaction was observed between any of the elements. Due to lack of response to phosphate, this experiment is to be discontinued.

A 16-plot trial of the fertilization of maize with placed phosphates and broadcast lime on the Tatagura silt soil with an overall dressing of Sulphate of Ammonia showed also no response to either phosphate or lime. This experiment is also to be discontinued.

Summer Wheat.—This experiment was carried out in conjunction with Dr. Bunzli of Pest Control. The experiment consisted of six spray treatments. The chemical sprays used were Amine salt of 2-4-D (Chlorophenoxyacetic acid) and M.C.P.A. (2- Methyl 4- Chlorophenoxyacetic acid). The 2-4-D was applied at the rate of 1lb. of the acid equivalent pre-emergence per acre and ½lb. of the acid equivalent post-emergence per acre, and the third 2-4-D treatment was a combination of the pre- and post-emergence treatments. The M.C.P.A. was applied at the rate of 2lb. M.C.P.A. pre-emergence per acre and 1lb. of M.C.P.A. post-emergence per acre, and the third M.C.P.A. treatment consisted of a combination of the above two treatments.

All weedkiller treatment showed a marked control of weeds over "no treatment" plots. The plots where both pre- and post-emergence treatment were applied were not better than the plots with single spray treatments.

Where Rapoko grass was prevalent, the 1lb. of the pre-emergence 2-4-D treatment was found to give the best results, while the post-emergence treatments alone would be the most economical to use.

On account of the wet season there was a fairly heavy infestation of rust, and the crop was about 2½ bags to the acre. Rust-free selections have been made, and critical experiments have been laid down on these selections at different fertility levels.

General.—At the end of the 1952-53 season it was decided to plough as much of the lands on the Station as was possible before the soil dried out and became too difficult to plough. This autumn ploughing proved very successful, as most of the lands that were ploughed before the soil dried out came over very well without large clods, which are very difficult to break down to form a good seedbed. This was particularly noticeable on green manured lands which required a minimum of work to prepare good tilth on seedbeds. Where the maize was stooked and the land ploughed as soon as was possible, the land did not plough as well.

All the farm maize lands were sprayed during the 1952-53 season with 2-4-D as a weed control measure. On the whole, this proved very satisfactory, because the early growth of weeds was checked, thus reducing the number of cultivations required.

Soil Conservation

With the co-operation of the Department of Conservation and Extension, which has an Engineer resident on the station, a series of runoff plots has been constructed to ascertain just how much water runs off under different conditions, such as pasture, cultivated annual crops, green manure, and bare cultivated fallow. These studies are in 3 sections, each with a characteristic slope. Measuring devices have been installed to give figures of the amounts of water and soil lost per acre each year.

Farm

The development of the farm has continued. Roads have been made and native quarters improved. Bilharzia-free water has been piped to the African villages. A school and three brick cottages for African staff have been built. Two African teachers, paid by the Education Department, are supervised by the Salvation Army Educational Officers.

A large amount of fencing which was in bad repair has been mended and realigned, and five miles of new fencing has been erected.

Machinery

Attention has been given to the acquisition of the right type of tractors and machinery for handling these difficult silty soils, and it is now clear that with suitable machinery, leys, fertilizer applications and good timing, these soils need not present such grave difficulties as they have in the past.

General

There is every prospect of achieving increases in crop production and a trebling of the existing livestock population, without any further extension of the land at present under the plough.

The need at the moment is for better training facilities for both European and African skilled farm workers, and a greater availability of fertilizers, at prices which are attractive enough to induce farmers to embark on a more liberal policy of fertilizer use.

Large amounts of milk and beef can be produced on the grain farms here and it is expected that the necessary information for development in this direction will be forthcoming in the next 2 years.

The European staff of the Station consists of 5 professional officers, 6 technical assistants and 2 clerks. Its revenue was in the region of £7,000.

Publicity.—In the course of the past 18 months, 11 scientific papers were published, 17 lectures were given away from the Station to Farmers' Associations, and 15 addresses were delivered by visiting scientists to the Henderson Scientific Society. Ten research and demonstration centres in Southern Rhodesia and many private farms were visited.

During the year under review, 1,192 official visitors to Henderson Research Station were recorded.

Fisheries

While the development and construction work of the Experimental Fish Farm on the station has continued, the Fisheries Officer has been able to devote part of his time to advisory work and the advancement of fish farming throughout the country. Intensive construction work started in May, 1951, and the stage has now been reached when the research programme can be satisfactorily inaugurated.

During the year under review, eleven organizations were addressed on fish culture, and sixty-two farms were visited to give advice and investigate the possibilities of fish culture. In the course of these visits, opportunity was taken to make observations on dams and rivers in an attempt to assess the potentialities of the areas. Assistance in this has been given by the appointment of Fisheries Committee by a number of Farmers' Associations.

Fry Production.—The supply of fry for the stocking of farm dams has continued. To facilitate this, fry production ponds have been built at the Demonstration Farm, Chipinga, where, in addition, there are demonstration ponds for fish production. It is interesting to note that from the cultivation of fry, a yield of about 1,500lb. per acre in nine months was observed at the station. This indicates that fish production of from 4,000 to 5,000lb. per acre per annum may be expected.

A centre for the production of trout fry has been built at Rhodes Estate, Inyanga.

There have been a large number of visitors to the station, and great interest was shown in the fisheries exhibits at the Salisbury, Bindura and Sinoia Agricultural Shows and the Bulawayo Royal Show.

GRASSLANDS RESEARCH STATION

The Grasslands Research Station at Marandellas is the Regional Agricultural Station for the sandveld of the high-lying north-eastern part of the Colony. Attached to it is a sub-station at Melsetter to serve the Eastern Border.

Weather.—The rainfall for last summer measured 56.85 inches, rather more than 22 inches higher than the average for the last eighteen years. It was evenly distributed, with no prolonged dry spells.

During June and July, ground frosts occurred almost daily, the average grass minima for the two months being 31.9 and 30.3 respectively. No frosts were recorded in the screen during those months. The Maximum Screen Temperature reached or exceeded 85° F. on sixteen days.

Station Development

During the past year the layout of the Station has been re-planned. A considerable amount of fencing has been put up and fifteen miles of new roads made. Three derelict boreholes have been cleaned and one equipped with pumps and storage for a four-acre winter pasture irrigation project. Well-equipped cattle kraals have been built at the dip.

The Station labour force has been moved from widely scattered compounds into a new central compound, conveniently situated as regards the work of the Station, in which semi-detached brick houses and latrines are being built.

Farming System Trial

The central theme of the Station's activities is the development of a system

of farming to suit the needs and limitations of the area served, and to this end a large-scale farming system trial is being followed. This is proving invaluable in guiding the detailed research, and in testing the results of such research on a farm scale. In this scheme the arable blocks follow a provisional nine-course rotation of six years productive ley and three years of arable crops.

All of the fodder required for the dry season was conserved in the form of silage. Hay was not made. Storage capacity for silage has been increased by the excavation of eight trench silos holding about 150 tons of silage each. The total storage capacity is now about 1,200 tons of silage.

Due entirely to the generous assistance provided by the Dairy Control Board, a Slade-Curran Batch-type Grass Drier has been purchased and erected in an open-sided shed. Grass drying on an experimental basis will start during the coming season.

Conservation

Lysimeters.—The uniformity trial of the Lysimeters has continued, for the third season running. For seven of the eight lysimeters the Coefficient of Variation in flow was only 1.2% and the range 3.8% of the mean flow. Run-off from the run-off traps has, as in previous seasons, been negligibly small.

Soil Conservation.—On behalf of the Department of Conservation and Extension, a 24-acre block has been ploughed so as leave the land in a series of parallel ridges and furrows, the distance between the ridges being sixteen yards and the fall along the furrow 1:300. During the past season this system has worked well in regulating erosion and run-off.

Four of our large arable blocks have been protected by the standard Rhodesian bank-and-ditch system of contouring. Erosion, which was very visible before this was done, appears to have ceased.

The small earth dam stood up to the last rains very well, and the contour-spillway fulfilled its purpose admirably. The dam is now well covered with Couch, Tanner and Star Grass No. 2.

Fertilizer Trials on Crops, Pastures and Veld

Maize.—In a preliminary study of the fertilizer requirements of maize on sandveld, encouraging results have been obtained from two fertilizer trials.

In the first experiment, on virgin land, the use of 250lb. of sodium nitrate per acre increased the dry-matter yield of grain from 390lb. per acre to 850lb. The use of 250lb. of super/rawrock phosphate had no apparent effect where no sodium nitrate was used, but increased the yield by 170lb. in combination with sodium nitrate. Potash and lime in moderate quantities had no apparent effect on grain yield.

In the second experiment, on second-year land, super/rawrock phosphate broadcast on the soil surface in the usual way at rates of 300, 600 and 900lb. per acre, was compared with banding the same quantities beneath the soil near the maize rows. The mean yield in the case of the broadcast dressings was 2,420lb. of grain per acre, whereas in the case of the banded dressings it was 3,230lb. Furthermore, 300lb. *banded* was found to give a slightly greater yield than 900lb. *broadcast*.

A further beneficial effect of phosphate-banding was found in the use of nitrogen. Increasing the dressing of ammonium sulphate from 300lb. to 900lb. *decreased* the grain yield by 480lb., where the phosphate was broadcast, but *increased* it by 1,110lb. where the phosphate was banded.

Several plots in the second experiment gave a dry matter yield of grain well over 4,000lb. per acre. Such a yield, allowing for the normal moisture content of maize as marketed, and allowing for the loss of yield entailed in harvesting the experiment before it was ripe (because cobs were being stolen), is equivalent to more than 30 bags per acre — from sandveld!

Maize for Silage.—In a fertilizer trial on maize grown mainly for grain and already reported on under "Maize", large dressings of fertilizer were used. It was found that the greatest dressings gave insignificantly greater yields of green material than the least. Results, therefore, may be summarized by saying that a dressing of 300lb. each of ammonium sulphate and super/rawrock phosphate was sufficient, if not more than enough, to give a yield of 6,940lb. of dry-matter for silage, with a stand of 9,680 plants per acre (probably too few plants for the best results).

Munga (Pennisetum glaucum) for Silage.—In a trial with munga in which only one fairly early cut was taken, plots receiving no nitrogen gave 2,230lb. of dry-matter per acre for silage, while increasing amounts of nitrogen up to 300lb. of ammonium sulphate per acre gave increasing yields up to 4,360lb. A further increase to 450lb. of ammonium sulphate per acre resulted in a relative fall in yield to 4,090lb. A dressing of 300lb. of super/rawrock phosphate per acre increased the yield by 1,200lb. Moderate dressings of potash and lime had no apparent effect on fodder yield.

Trace Elements on Legumes.—During the past year, an experiment was laid down to study the effect of small quantities of molybdenum (sodium molybdate), manganese sulphate, copper sulphate, zinc sulphate and boron (sodium borate) on four different legumes. The effects of inoculation, lime, and nitrogen (ammonium sulphate) were also studied in the same experiment, as it was thought that they might affect growth themselves, or that they might affect the action of the trace elements.

Effects were tested with four legumes, namely, Soya Beans, Velvet Beans, Glycine javanica, and Laucaena glauca. Although both Glycine javanica and Leucaena glaca germinated well, a very poor establishment resulted, and it was decided to disregard these two species in measurements made to determine the effects of the treatments imposed. The Velvet Beans grew well, but were more or less unresponsive to treatment. Soya Beans responded well to treatment, and such remarks as follow should be understood to refer only to Soya Beans.

As the data from this experiment are still largely unexplored, the main practical indications shown by the Soya Beans are subject to amendment.

Fodder Yield of Soya Beans.—It was found that inoculation increased the yield from 1,100lb. of dry matter per acre to 1,900lb. The crude protein content of uninoculated plants was 9.9%; that of inoculated plants 14.7%. No other treatment effects were observed except that nitrogen, as 300lb. of ammonium sulphate, tended to lessen the effect due to inoculation.

Grain Yield of Soya Beans.—In the case of the grain yield, inoculation increased the dry-matter grain yield from 375lb. per acre to 940lb. per acre. Nitrogen as with the fodder yield, tended to lessen the effect due to inoculation. Manganese, as 15lb. of manganese sulphate per acre, increased the bean yield of inoculated plants by 40%, but had no apparent effect on the yield of uninoculated plants.

When sampled at sixteen weeks after sowing, inoculated plants had about 120 nodules each, and uninoculated plants about 1 each. Inoculated plants from limed plots (1,000lb. of Agricultural Lime 42% CaO) showed just double the number of nodules found on plants from unlimed plots. Despite this, lime had no significant effect on fodder and bean yields. Zinc, as 10lb. of zinc sulphate per acre, tended to lessen the effect of inoculation. At the time of sampling it was found that nodules from inoculated plants were nearly four times as heavy as those from uninoculated plants, and that inoculation was the only treatment that had any significant effect on nodule weight. Fodder, bean and nodule yields as high as 3,470, 1,700 and 187lb. of dry-matter per acre respectively were observed.

In the case of Velvet Beans, fodder, bean and nodule yields as high as 3,400, 1,230 and 47lb. of dry-matter per acre were observed.

Star Grass Pastures.—The investigation of the effect of fertilizer on Star Grass (No. 2) has continued. In the six experiments carried out during the season, attention was concentrated principally on the use of nitrogen and with the effect of other fertilizers on the response to nitrogen. All yields were of material suitable for hay or silage.

In experiments cut twice a season, substantial increases in seasonal yield were obtained with each 300lb. increase in dressings of sulphate of ammonia up to the 900lb. maximum used, yields of $2\frac{1}{2}$ to $4\frac{3}{4}$ tons of dry matter being obtained, as compared with less than $\frac{3}{4}$-ton where no nitrogen was used. *In one experiment, however, on an area where the level of fertility was known to be high, an increase of $2\frac{1}{2}$ tons (from 4 tons to $6\frac{1}{2}$ tons) was secured with the first 300lb. used, and there was very little further response to the greater dressings.*

In an experiment cut three times during the season and dressed with up to a ton of ammonium sulphate (or its equivalent in other form of nitrogen), a total yield of almost 9 tons of dry matter per acre was obtained, and it is expected — chemical analyses are not complete — that the yield of crude protein will be about a ton per acre.

Responses to top-dressings of 300lb. of super/rawrock phosphate applied in all cases at the beginning of the season have been variable, ranging from a negligible response up to a 30% improvement in yield. In one experiment, increasing the dressing from 300lb. to 900lb. led to no increase in yield. There is some indication that phosphate is effective only early in the season, all improvements in yield found have been with the first cut, and dressings given for the second cut had no apparent effect.

Lime, up to 3,000lb. per acre, tended to depress the yield of grass. Potash usually had no appreciable effect on yield when applied at the rate of 100lb. of muriate of potash per acre, but tended, if anything, to depress yields slightly when applied in excess of 150lb. per acre.

Dressings of agricultural lime, super and rawrock phosphate, and muriate of potash have not apparently influenced the response to nitrogen.

Other Grasses.—In a trial on a new stand of Giant Rhodes Grass, the yields were generally high and showed but small response to nitrogen in the first of the two cuts which were taken. In the second, the yield was increased from 2 tons of dry matter per acre to 3 tons by the second application of 450lb. of ammonium sulphate with the 900lb. per acre treatment. Yields for the season exceeded six tons of dry matter per acre on some plots, while the average crude protein content of the first cut exceeded 13%.

A parallel experiment with a broad-leaved strain of Panicum *maximum* from Mount Selinda, grown at approximately 3ft. x 3ft. spacing, gave similar results. In the first cut the general yield was good and the response to nitrogen small; but in the second cut the yield was increased from 2½ tons to 3½ tons of dry matter per acre by the second application of 450lb. per acre in the 900lb. per acre treatment. Yields for the season in this trial exceeded seven tons dry matter per acre from some plots, while the average crude protein content for the first cut was almost 12%.

Both these trials were carried out on stands of grass planted late in the previous season in the same field after fallowing, and the lack of response to nitrogen in the first cuts on the newly established pasture is taken to indicate that sufficient nitrogen was supplied by nitrification while the stand was new, rather than that these particular grasses are less in need of nitrogen than others for good growth.

With Rhodes Grass, the response to 300lb. of super/rawrock phosphate applied at the beginning of the season was large in the first cut but neglibile in the second, whereas it was negligible in both cuts in the case of the *Panicum maximum.*

Dressing with lime and potash had no appreciable effect on yield with either grass.

Veld.—In a fertilizer trial which has developed where a dense stand of Brachystegia-Julbernardia woodland (Msasa) was cleared in 1948, steady increases in yield have been obtained with dressings of ammonium sulphate up to the maximum of 900lb. used; a yield of 3¼ tons of dry matter per acre being obtained at the 900lb. level, as compared with less than ¾-ton where no nitrogen was used. Moderate dressings of lime, phosphate and potash had no apparent effect on yield.

Nursery Work

Grasses and Legumes.—Good progress was made in the bulking-up of some of the new grasses for seeded pastures, particularly of the Bambatsi Panicum, Katambora Rhodes Grass, Chipinga Cenchrus, and Dubi Grass.

Several interesting collections of new species and varieties were made in the Sebungwe District, Inyanga North, and in the Sabi Valley. These grasses are at present being grown in observation plots, and some of the most promising will be bulked during the coming season.

A number of samples of Glycine seed have been obtained from several different localities. These will be grown in observation plots. Stocks of *Optoptera Burchellii* have been increased by roots sent to us from the Matopos Research Station, from which Station several bags of roots of a special strain of *Phalaris arundinaceae* and of the mpindo Vlei Grass have also been received.

Seed Registration.—A Provisional Scheme for the registration of Pasture Seeds has been prepared for the Rhodesian Pasture Seed Growers' Association which is being formed under the auspices of the R.N.F.U.

Summer Wheat

Three selections of Summer Wheat from Kenya were received from the Chief Agriculturist for testing. For various reasons sowing was delayed until 24th March.

In this trial No. 360 was outstandingly better than the other varieties, and has produced a fairly thin stand of nice, well-filled ears which are ready for harvesting. During the coming season further attention will be paid to both Summer and Winter Wheats.

Grass/Legume Pastures

The successful establishment and utilization of field scale, *grass/legume pastures* is an important achievement which marks a new development in Summer Rainfall Agriculture.

The summer growing annual, Korean Lespedezia, as well as *Rhaseolus lathryoides,* a short-lived perennial vine, *Leucaena glauca* (Vi-Vi), a woody shrub, and *Cajanus indicus* (Dahl), a woody shrub, were all successfully established on a field scale and are being subjected to grazing trials.

A 24-acre Rhodes Grass, Dahl pasture has given most promising results. Established by seeding at the beginning of the season, it has provided a lot of very good grazing to both beef animals and dairy cows. During the period 23rd July to 21st August, beef steers grazing on this pasture gained at the rate of 1.4lb. per steer per day when comparable steers on veld grazing were losing weight at the rate of 1.5lb. per steer per day.

An acre pasture of Cenchrus ciliaris with Leucaena glauca yielded 1,700lb. of hay in addition to providing 220 grazings days (1,000lb. steer equivalent) during which a very satisfactory rate of liveweight increase was maintained.

Pastures for the Dry Season

Foggage Pastures.—The very long, dry season imposes a limitation on production which is usually countered by the conservation of roughages grown during the rainy season. In addition to work on various forms of conserved feed, other ways by which production may be increased during the dry season are being investigated. These investigations include the use of late pastures, and foggage or "kept-over" grazing for use after the late pastures have ceased to be productive.

Of the species tried so far the most promising are:—

Grasses: *Setaria sphacelata.* Kazengula and Bua River strains.

Panicum maximum. Sabi and Kabulabula strains.

Panicum coloratum. Var. Makarikariensis. Bambatsi strain.

Napier Fodder. Cameroons and Gold Coast strains.

Legumes: *Cajanus indicus.* Dahl or 'nDola Beans.

Phasiolus lathryoides.

The use of grazings composed of various mixtures of the above species made it possible to maintain the herd of 24 dairy cows, and to obtain a very satisfactory milk production, from 6th April — when the Star Grass pastures were finished — to 20th June, when a full ration of silage had to be fed. Feeding of silage commenced with a very small daily ration on 27th May and was gradually increased in quantity up to a full ration on 20th June. If the late grazing and foggage had not been available, a full ration of silage would have been fed from 6th April.

The use of the late pastures and foggage grazing enabled seven steers to be kept in such good condition that betwen 24th June and 19th October they lost an average of only 3lb. each, whereas seven steers grazing on veld lost an average of 120lb. each. Although this trial was on a small scale, it serves to indicate the possibilities of special purpose pastures for the Dry Season.

Vlei and Irrigated Pastures.—The feasibility of milk production from dryland summer pastures is already established. If it were possible to provide high-quality grazing during the dry winter months, the solution to the problem of year-long production from grass would be within our grasp.

On the Station, and in much of the area it serves, are large areas of vleis, many of which remain wet throughout the dry season. There are also great possibilities for the irrigation of pastures on topland.

This year, in an approach to the problem, pastures of winter-growing grasses and clovers have been successfully established in vlei and are being grazed. Promis-

ing species are *Tall Fescue, Italian Rye Grass, Phalaria tuberosa, Phalaris arundinaceae, Chilean Red Clover,* and *New Zealand White Clover.* Other varieties of grass and clover are under trial. An irrigation scheme which is under construction will make it possible to begin work on irrigated winter pastures during the coming year.

Milk from Grass

In the summer of 1952-53, the Friesland dairy herd was used to determine the value of fertilized leys for milk production.

In the light of the experience in that season, it was decided this year to move the herd more rapidly over the pasture, so that they might obtain younger and more nutritious grazing. With the aid of an electric fence, one area of Star Grass was grazed three times from 10th December to 3rd February. Throughout January and February the grass proved capable of providing maintenance plus 3 gallons of milk.

About 148 grazing days per acre were obtained from the Star Grass this season, as compared with 137 obtained during the previous season. The production of milk per acre cannot be given in detail, due to the mixed stocking with sheep, young stock, and dry cows that was practised.

Experience shows that Star Grass is essentially a mid-season grower, and needs to be supplemented by pastures of earlier and later species for early Spring and Autumn grazing.

Veld Studies

Mineral Supplementation.—The study of the effect of mineral and protein supplements on the growth of beef steers grazed on veld, which has been running for some years, was continued. The results obtained this year confirm those of previous years.

It is most striking that salt, fed at the rate of 1 or 2oz. per head per day throughout the year, causes an increase in liveweight, and the effect of feeding salt throughout the year is at least as great as that of feeding a protein supplement during the dry season.

Starting with an average weight of 330lb., the present groups have made the following liveweight gains over the past two years:—

Protein in winter	468lb.
Salt throughout the year	482lb.
Salt throughout the year and protein in winter ...	508lb.

A comprehensive programme of investigations dealing with the ecology and management of the natural veld is being laid down. Most of this work has only begun, and no results have as yet been obtained.

Livestock

During September, 1953, all the cattle on the Station were subjected to the Tuberculin Test. Out of the total of 550 head only three steers reacted positively. All the breeding stock were tested for contagious abortion, and all were found to be free of the disease.

The dairy herd of 26 cows with heifers and followers has maintained a high level of production with a herd average of 1,034 gallons.

The Shorthorn herd — 30 head of mature cows — has continued to improve in condition. Calves born in November, 1952, reached an average liveweight of 485lb. at eleven months.

Our policy with regard to the sheep has been recently altered. One flock of cross-bred ewes (Blackhead Persian x Dorset Horn) has been selected for grading-up to German Merino for use on grass leys. A flock of pure-bred black head Persians will be retained for use on veld.

General

Seed and Root Distribution.—Sixty-five samples of grass and legume seed were distributed last year. Much of it went to farmers in Southern Rhodesia. In addition, seed was sent overseas to Mauritius, the U.S.A., India, Curacao, and the F.A.O. of U.N. in Rome; also to Northern Rhodesia, Nyasaland, the Sudan, Tanganyika, Belgian Congo and South Africa.

Over 3,400 bags of grass roots were distributed during the year, compared

with 553 bags last year. Roots went to 148 recipients, most of whom were farmers. Tanner Grass was supplied for the wall of the Hunyani Poort Dam and Star and Tanner for the Marandellas Dam.

Agricultural Shows

The Station organized exhibits on the Salisbury, Umtali and Chipinga Shows. These exhibits attracted numbers of interested persons, who were able to have their questions answered and their problems discussed by the professional officers who were in attendance.

Visitors.—A great number of people visited the Station during the year and on the 27th of February over 600 persons attended a most successful Farmers' Day at Grasslands.

MELSETTER SUB-STATION

The work of the Melsetter Station, which serves the high rainfall Eastern Districts, is directed towards the introduction of an intensive system of farming in which permanent and ley pastures will play an important role.

Dairy Unit.—A small herd of Jersey cows is run on a series of established pastures in order to investigate the possibilities of butterfat production from pasture supplemented by the minimum quantity of imported concentrates. The aim is to develop a fodder sequence, including irrigated pastures for the dry months, which will enable concentrate feeding to be dispensed with entirely.

Eleven Jersey heifers in milk, one bull and four young heifers ran on 14 acres of pasture as follows:—

Dryland 1.—Kikuyu, 1 acre.
Dryland 2.—Paspalum dilatatum, 2 acres.
Dryland 3.—Kikuyu and New Zealand White Clover, 7 acres.
Dryland 4.—Paspalum dilatatum and New Zealand White Clover, 2 acres.
Dryland 5.—Napier Fodder, 1½ acres *for silage*.
Irrigated 6.—Kikuyu and New Zealand White Clover, 2/3 acres.

The herd average was 4,725lb. and the average milk production per acre was 3,713lb. Butterfat production per acre averaged 185lb. For almost nine months no concentrates were fed.

Costs per acre were as follows:—

	£	s.	d.
Average cost of pasture establishment	7	4	10
Cost of concentrate feeding	4	18	7
Labour: milking, calf feeding, dairy cleaning, etc. . .	5	0	0
TOTAL	£17	3	5

Returns per acre:—

	£	s.	d.
185 lbs. Butterfat . . . . @ 3/6d. per lb. . . .	32	7	6
371 gallons Skim Milk . . @ 6d. per gallon . .	9	5	6
Value of four Heifers born and bred on Unit @ £45 ea.			
Less cost of milk already accounted for . . @ £20 each	7	2	10
TOTAL	£48	15	10

Other Established Pastures.—Quarter-acre pastures of fifteen grasses that showed promise in previous nursery trials were grazed by six old oxen.

The cattle were moved from small paddock to small paddock as grazing was available. The grazed areas were topped off by mowing after they had ben grazed. In this exploratory trial the six oxen did very well on a total of 4¾ acres from 18th October, 1952, to 30th May, 1953, i.e. for 7½ months. It was not possible to obtain weights during the period of grazing, but the C.D.W. when slaughtered at the Cold Storage Commission ranged from 689 to 799lb.

Observations indicate that most grazing was obtained from Mt. Elgon Star, which was closely followed by Tanner grass, Napier Fodder, Milanji Finger grass, Star grass type "C", Giant Star, Makarikari, Panicum "kabulabula", Kazungula, Panicum Maximum (Rhodesia), Nile grass, Ngamiland setaria, Tall Fescue, Panicum maximum (Chipinga), in the order given.

It is planned to introduce Glycine javanica and a local Dolichos sp. into the ¼acre pastures.

Kikuyu-Clover Trials.—New Zealand White Clover, Mbulu Clover (3), Ladino Clover and S 100 Clover were tried with Kikuyu in approximately one-fifth acre plots on two soil types — well-drained soil and vlei soil. The plots received 300lb. Super and Raw Rock Phosphate and ½-ton of lime per acre before they were planted. The plots were grazed intermittently from April onwards.

Observations on both soil types showed *New Zealand White and S 100 Clovers* to be outstanding. Of the two, *S 100* appeared the better.

The *Ladino Clover* was disappointing, making very poor regrowth after being grazed. Mbulu Clover made poor growth, and its roots did not appear to be nodulated.

Napier Fodder and Glycine javanica.—One hundred pounds of seed of Glycine javanica were collected in the veld. Four acres of Napier Fodder/Glycine javanica have been established.

Irrigated Pastures.—A beginning has been made on an irrigation scheme which will enable a small acreage of winter green irrigated pasture to be established. A Phalaris/clover pasture has already been established on the site and will be ready to irrigate when the scheme is completed.

Veld Management.—The effect of fire at different seasons and intervals on the indigenous *Smithia thymodora* scrub is being studied in two trials which have been running for a number of years. It is interesting to note that in the plot which is afforded complete protection *Aischynomene nodulosa* is invading and overshadowing the Smithia.

In the plot which is mown annually *Smithia thymodora* appears to have been completely eradicated and the bracken much weakened and reduced.

The June burn has exercised a most depressing effect on Smithia but appears to have encouraged Senecia spp. as well as bracken, etc.

In the plots which are grazed as well as burned, the June burn has produced similar effects. There is no doubt that the burns made after the Spring rains are producing better results than burns made at the end of the dry season before the rains start.

MATOPOS RESEARCH STATION

Staff.—All posts have been filled as far as European Staff is concerned and the establishment consists of 31 officers with an additional one seconded from the Native Department and stationed at Tuli. Of the four African posts, two require to be filled.

Housing.—The housing position continues to be extremely difficult, as all the married quarters are occupied and there are 9 single officers on the staff, several of whom are anxious to get married. One house for an Animal Husbandry Technical Assistant has been almost completed with our own labour.

Climate.—The rainy season was abnormally high, 32in. of rain being recorded, while the dry season has been unusually cold, with grass minimum temperatures as low as 8° F.

Animal Husbandry

Development.—Apart from the building of two ensilage pits and the stumping of fifty acres of ground for crop production at Lucydale, development work was limited to general repairs of fences, roads, cattle pens, dip tanks and water supplies.

Cattle Breeding.—An analysis of the results obtained from the breed comparison studies shows that unless the general level of livestock nutrition in the ranching areas is raised very appreciably, there is no object in importing improved breeds to increase beef production in these parts.

There is much speculation on the degree to which the nutritional values of the pastures can be increased economically through winter supplementation, but all available evidence seems to indicate that for a long time to come livestock production in the less efficient rainfall areas will be dominated by a shortage of winter feed.

From a genetic point of view, therefore, and considering that in the selection

of economic characters, animals are selected on their response to particular sets of conditions, it seems possible to conclude that better results will be obtained by selecting for greater efficiency of production under existing ranching conditions.

To test the effectiveness of this system of selection it was agreed in consultation with the Rhodesian National Farmers' Union that the differences in production between various breeds should be determined when the same intensity of selection is practised on free range.

These experiments are to commence at the beginning of the breeding season, and for this purpose the Native, Africander, and Africander x Hereford crossbred herds on this station will become closed herds and no new blood will be introduced.

Nutritional Studies.—The results of the feeding trials which are being prepared for publication show that owing to the low efficiency of feed conversion in beef steers and the high costs of producing good quality feeds locally, the economic benefit derived from fattening steers are small. Experiments are therefore to be carried out to determine the profitability of supplementing breeding stock in winter to obtain higher calving percentages.

Sheep Breeding.—The results obtained from the sheep breeding experiments show that there is little advantage in cross-breeding, and the plans of these studies have been changed to establish smooth-coated breeds from the Dorset Horn x Persian and Wiltshire Horn x Persian crosses.

Pig Production.—A number of studies were conducted to determine the influence of antibiotic supplementation on pig growth. The results obtained showed that although growth was stimulated slightly by adding aureomycin fermentation products to different pig rations, the differences were small and of doubtful economic importance.

Dairy Research.—During the course of the year a Friesland herd was established at Matopos, and as soon as numbers permit, experiments will be carried out to determine the relative influence of various factors affecting milk production in Matabeleland.

Lectures on animal breeding were delivered to livestock officers of the Department of Conservation and Extension, and close co-operation was maintained between the two Departments.

Field Husbandry

Development.—A greenhouse and additional storage space on the new barn has been completed. Also grain stores were sealed at the eaves and roof to permit effective fumigation.

Improvements on the Sandveld Fertility Trial sites were completed in April.

The area for Sandveld Experiments has been increased by incorporating a new block.

A reservoir with a capacity of 30,000 gallons is being constructed.

Sorghum.—36 Sorghum grain varieties were tried for yield on clay soil, and two new Argentine varieties 5,152 and 5,140 significantly outyielded all other commercial varieties with the exception of Dwarf White Milo. They also showed a high resistance to bird damage.

In the silage trial, Napier Fodder significantly outyielded the tall sweet stemmed sorghum, maize and millet varieties. In addition, yields of all varieties were considerably higher on clay than sandveld soil.

Three sorghum varieties maturing at different times were tested at different spacing and planting time to compare effects on yields; they were—

Variety	Maturing in	Optimum	Spacing ½ Optimum	¼ Optimum
E. Hegard Combine .	90 days	2′ × 6″ × 6″	1′ 3″ × 3″	7″ × continuous
Black Kaffir . . .	115 days	2′ × 6″ × 6″	1′ 3″ × 3″	7″ × continuous
Haakdoorn	130 days	3′ × 5″	18″ × 7″	9″ × 4″

Planted in November, December, January and February. ½ Optimum spacing together with December planting resulted in higher yields in the case of all three varieties.

Maize.—6 white hybrids and 6 open pollinated varieties were compared for grain yields on clay and sandveld soil where Sahara gave 16 bags/acre. Early Pearl was the highest yielder on clay soil with only 5 bags/acre. Further, the hybrid 52 D.H. 6 significantly outyielded the hybrid 52 D.H. 32 on sandveld, but there was no significant difference on clay soil.

In the green manure trial, 1st year results indicated that legume yields were depressed by compost applications. Second-year results showed that maize yields were increased by heavy compost application (10 tons/acre), but light applications (5 tons/acre) gave no increase over untreated plots. This indicates a residual effect of the previous season's green manuring; however, it is insufficient to maintain yields.

Rotation and Cultivation.—The rotation trial on the effect of a number of cropping systems on soil fertility and structure has only run for one season and there are still 4 seasons to complete.

The green manure trial showed that Sunnhemp resulted in the highest yields of maize grain and sorghum dry material. Further Sunnhemp was the only crop which maintained a constant position as regard its effect on the yield of the following crop.

Sunflower.—In testing 8 varieties, results showed that Mars did well by maintaining a comparatively high yield on both soil types; other varieties showed much wider variations. Russian Giant and Saturn are long-maturing varieties, and certain micro climatic conditions during the growing period may account for the fluctuation.

Stokroos.—Results showed that Roselle significantly outyielded Egyptian and Brazilian, the other two varieties.

In addition, Roselle gave the best fibre sample on retting and also showed a more erect growing habit.

Cotton.—In a fertilizer trial involving three treatments; (1) Compost at 5 tons per acre, (2) Compound C at 400lb. per acre, and (3) Compound C at 400lb. plus 40lb. per acre of Sulphur on clay soil.

Results indicated that Compound C at planting times has higher yields of green material than either of the other two treatments. As the bolls were frosted in the immature stage, green weights were taken.

Wheat.—Six varieties of summer wheat were tested under natural rainfall conditions, however, yields were very low, the highest being Kenya Governor with only $1\frac{1}{2}$ bags per acre. The low yields could be attributed to birds, which were a constant menace, and as the plot was only $\frac{1}{2}$-acre, damage was more concentrated.

Research Breeding

Sorghum.—Selection was carried out on 43 tall, 19 dual purpose, 72 dwarf and 36 double dwarf varieties. The trial hybrids Angeni and Sambura were satisfactory, and selections will be back crossed next season.

Maize.—The first double cross and top cross yellow maize proved slightly better than open pollinated Sahara, however, the season was unsuitable for testing drought-resistant characteristics. Six new double cross varieties were produced and a new double dwarf quick-maturing maize was investigated.

Selection continued with 108 inbred lines and 25 lines were discarded as being below standard.

Millet.—Double dwarf millet grew poorly in the wet conditions this season, but the dwarf bristle awned millets are showing promise as grain types, and selection and inbreeding is being continued. Silage millets grew well on sandveld soil and inbreeding and selection is resulting in some promising lines. In all, 72 millet species were grown for selection.

Plant Introductions.—There were 41 re-introductions from the previous season's failures and 129 new introductions, of which there were 65 sorghum varieties, 56 maize varieties and inbreds, 39 millet species, and 7 legume varieties.

Seed samples were sent to farmers, and three articles on sorghum were written for the *Rhodesian Agricultural Journal* and *Bulawayo Chronicle.*

Development.—A considerable amount of development work has taken place during the year. This includes the construction of three 30-ton silage pits, five small experimental silage pits, a reservoir, a tank stand and drinking trough, a transformer house, servants' quarters and a sunshine recorder stand. Alterations were carried out in the Hull House flat, a vehicle inspection pit was built, and 4,000 cement bricks were made.

New firebreaks totalling just over five miles were stumped, cleared of grass and graded. In addition, a distance of 9.2 miles has been stumped and mown to a width of 30 feet as added firebreak protection. 35 miles of existing firebreak road has been graded and 15 miles of firebreak has been burnt.

The whole of the main nursery as well as the sandveld nursery has been surrounded with a game-proof fence. Experiment 37 has been fenced, and all existing fences have been repaired where necessary.

About 130 tons of hay were cut during the year. In addition, some 190 tons of grass silage were made.

Research.—Valuable information continues to be obtained from the veld management experiments.

It is now very obvious that sound systems of deferred rotational grazing are essential if veld is to be maintained in good condition. Experiments are showing that in order to attain this standard, the main principles to be adhered to are the following:—

1. The stocking rate must be in accordance with the carrying capacity of the veld. On very mixed veld such as is found at Matopos, a paddock that is correctly stocked should still retain approximately 40% of the grass by the time it has been sufficiently grazed. That is to say that the stocking rate must be assessed on the amount of palatable grasses present and not on the total grass population.

2. The provision of adequate summer rest from grazing is essential. Damage, particularly on the heavy soils, can be caused very quickly if veld is grazed too frequently in summer.

3. Active measures have to be taken to reduce the density of existing bush and to control bush encroachment. The use of fire appears to be the most practical method. Where fire is employed for the purpose of controlling bush, it is important to burn at the correct time of the year and at the correct frequency. The best time to burn is at the end of the dry season just before the rains set in. Experiments are showing that burning at other times of the year can cause great damage to the grass and do very little or nothing to set back the bush. A fire once in four years appears to give the best results and puts as little grazing as possible out of commission each year.

Experiments during the past eight years have shown that haymaking, apart from allowing a slight increase in carrying capacity and providing a useful reserve against drought, is not a paying proposition. Hay-fed animals do only as well as animals given access to veld grazing during the dry season, as the hay that can be produced is of inferior quality.

Methods of providing animals with a dry season maintenance ration have been investigated during the present dry season. Very promising results have been obtained from feeding ensilage made from veld grasses. Another system investigated is that of supplementing roughage diets with urea and molasses. Results to date are most encouraging, and the work will be expanded and continued.

A stocking rate experiment based on the three herd/four paddock system of deferred rotational grazing has been laid down in the sandveld. This is expected to yield interesting data.

Run-off studies have been in progress for a year. As yet the only large differences in run-off obtained as a result of treatment are from the bare plots. In these very much more soil and water is lost than in the other treatments. It is likely that the effects of some of the other treatments will not be apparent for some time. The lysimeter work will not come into full operation for another year, as further callibration work is to be carried out during the coming season.

Promising results are being obtained from the grass and legume seeding trials.

After 5 years' trial the West African Napier Fodders, Guinea Grass and

Sorghum have yielded more as ensilage crops than any other grass or annual crop tried out. Yields have been the same from the grasses spaced 3ft. x 3ft. as from those spaced 3ft. x 6ft. and 6ft. x 6ft.

With regard to hay and grazing grasses, the highest yields are being obtained from the Panicums and from the Seerust strain of Conchrus cilaiaris.

Large responses are now being obtained from applications of ammonium sulphate on Napier Fodder. In the past season responses were also obtained from legumes used between the Napier Fodder rows as green manure crops. These responses appear to be largely dependent on rainfall.

Phaseolus lathyroides and lucerne are giving promising results under dry land conditions.

Valuable information will be obtained from co-operative experiments being run in Native Reserves and at the Mzingwane Government School.

A good deal of survey and advisory work was carried out by members of the staff in both European and Native areas.

The labour position has deteriorated seriously since last year, and the work is suffering as a result. A very large amount of propogating material has been distributed to farmers and other interested persons for the establishment of grass nurseries. Grassfires have been a very serious threat to experimental work during the present dry season.

Nyamandhlovu Sub-Station

Development.—Nurseries and new arable blocks of 15 acres each were established on the Kalahari sands and the black vlei (basaltic) soils. The nursery on the red sandy loam was expanded. All these areas were fenced off and netted in. Repairs were carried out to the offices and to the house in order to make them more habitable. A start has been made in building up a reference herbarium for the station.

Research.—The results from the various trials begin to show up more clearly each year, and really interesting information is beginning to be forthcoming. Unfortunately, this past season was a very abnormal one and results obtained in it have to be interpreted with caution.

Veld Management.—On the Gusu (Kalahari) sands, which can only be used for summer grazing because of the presence of the poisonous Mkouzaan (Dichapetalum cymosum), it is apparent that mowing is insufficient to control coppicing of bush. Further, because of the presence of Mkouzaan in the hay, animals fed this hay are liable to succumb to it.

Burning appears to be giving satisfactory control of bush, and it is expected that by removal of surplus trees by this means that the carrying capacity of the veld can be stepped up from about 13lb. per acre to about 35lb. per acre. These figures refer to summer only.

Cattle are removed from the Gusu in the dry season and taken to the black vlei veld, which because of puddling, cannot be satisfactorily used in wet weather. Here several systems of grazing and mowing are being investigated. Although the cattle do better when allowed to graze in winter, more animals can be carried if fed on hay. The costs of mowing will have to be accurately established in order to determine which system will be the more economical. Investigations also need to be carried out into the use of urea in conjunction with the winter maintenance of cattle.

The veld which has been alternately mown and grazed on the black vlei has improved more than that which has only been grazed each winter.

On the red sandy loams, which can be utilized at all times of the year, clearing of the bush again results in an increase of the carrying capacity. The stocking rate trial is yielding valuable information, but it will have to run for much longer before beef production can be accurately linked with the stability of the veld.

The best system of managing this veld type appears to be the (one herd-four paddock — with burning) system, though others may give temporarily higher returns.

A comparison between animals grazed on this veld type in winter and those

fed on hay also shows that the animals do better on the veld, but that more animals can be carried if fed hay.

The browse experiment continues to bear out previous findings that the increase in the amount of grass when all bush is cleared out of a paddock more than compensates for whatever benefit the animals might have derived from the browse.

A comparison of the feeding qualities of the hay cut from the various veld types showed that this season the black vlei was the best and that from the red soil was the poorest. Last year the vlei hay was the poorest, so further comparisons are needed.

Crops.—A trial was made of growing winter wheat on land that had been fallowed all summer, a block being established on both the Kalahari sands and the black vlei. Birds and buck prevented any crop being harvested, but results were sufficiently encouraging to justify repeating the trial, particularly on the vlei. Adequate safeguards will have to be instituted against game damage.

On 10 acres of sorghum, 6 mature steers have been grazed for 3 months during winter, during which time they have gained an average of about 60lb. each, which is very satisfactory. They showed a preference for Haakdoorn over YSH sorghum, and only when these were quite finished would they eat any Inyouti (Pearl Millet). Gains might possibly have been better had not Queleas stripped the grain off all the heads.

Zeerust Conchrus and Gold Coast Napier again appeared to be the most promising grasses, but other that were also very good were Bambatsi Panicum and Upright Makarikari, Chipinga Conchrus and a local Rhodes Grass. Star grass did quite well on the Kalahari sands, and Egyptian Lucerne and Jungle Grass (Echinochloa sp.) on the vlei.

Rustenburg and Early Hegari were the most promising of the grain sorghums tried, thought Caprock would have done well on the vlei had not Queleas intervened. A densely bearded, large-headed strain of Inyouti selected by the L.D.O. at Tjolotjo shows great promise of combining bird resistance with high yield.

The section continues to evoke increasing interest in the farming community, but pressure of other duties prevents the Pasture Research Officer from carrying out many visits to farms or from organizing visits of parties of farmers round the station.

Work has been somewhat handicapped this past season, as only one tractor and eight very old oxen have been available. Excessive rains, rendering roads and lands impassable, also hindered the programme.

An average of just over 30in. of rain was recorded on this station, which is considerably more than the average of about 19in. Exceptionally severe frosts were recorded, the lowest temperature being 10.9° F.

Bird Control.—Investigations have been limited in the year under review. A colony of Queleas was dynamited and useful data obtained as to the optimum size and spacing of charges. This would appear to lie between two and five 50lb. cases of 60% ammon dynamite per acre, when charges are placed about 20ft. apart.

Other African territories are taking an increasing interest in the Quelea problem, and contact is being maintained with all the territories affected and advice given on the basis of the findings here.

Ringing of Queleas to study their migratory habits and range continues on a limited scale. In addition to the return of one ring from Monze, in N. Rhodesia, reported last year, a further one has been reported from Cholo in Nyasaland. Both birds were ringed in Matabeleland.

Damage to crops this past season has been relatively limited, probably because of the large quantities of grass seed available and also because the season enabled farmer to plant early. As usual, the main concentration of Queleas was in the low-lying portions of the Colony.

Tuli Sub-Station

Development.—Considerable progress has been made in the general development of the Station in spite of labour and European staff difficulties. Work is in progress on a house for the technical assistant. Compounds for the native labour were erected.

By the 3rd of June the fencing of the main block was completed, with the exception of the erection of droppers. 28 miles of 4-strand fencing were involved and 40 "concertina" gates were made and installed.

The main experimental block comprising 1,620 acres is enclosed by a perimeter firebreak 30ft. wide. Internal road firebreaks are 20ft. wide. Roads and firebreaks total 13 miles, all of which has been cleared, stumped and graded.

Two boreholes serve the experimental area. One was tested at 180 g.p.h.; the former has proved most unreliable and it is has been necessary to use a watercart. The water position is therefore unsatisfactory.

Research.—On the 4th of June steers approximately 17 months old were introduced into the veld management experiments.

There are five large-scale veld management systems on trial which are designed to supply information on suitable systems of management for the area, on the use of fire in veld management and its effect on the vegetation, on the relative merits of grass and browse plants and on the carrying capacity of the area.

As the experiments have only been in operation for some 4 months, it is much too early to expect any definite results. Up to the 24th of September, as reflected in the cattle weights, this type of vegetation proved to be a maintenance ration for 21-month-old steers.

Proposed Experiments.—There are three small-scale experiments dealing with veld burning, bush clearing and ecological aspects which will be surveyed as soon as the programme allows it.

During the past rainy season a total of 26 inches was recorded, and frosts of unusual severity were noted on 5 nights during June and July.

Visitors.—A very successful farmers' day was held on the 16th July, when members of the Gwanda and District I.C.A. attended. The Secretary for Agriculture, the Director of Research and Specialist Services and the Chief Pasture Research Officer have all visited the station during the past year.

Aerial Survey.—Arrangements have been made to have an aerial survey of the area.

Poultry Section

Development

Buildings.—With the money made available, two laying houses will be constructed. Lack of labour retarded building operations.

Research.—Due to illness, further observations on the cause of Ocular Lymphamotosis and the suitability of deep litter in poultry houses were discontinued. A successful poultry day was held which was attended by 75 adults and a number of members of Hillside School Young Farmers' Club.

A successful poultry day was held on the 7th of March, which was attended by 75 farmers and a number of children from the Hillside School Young Farmers' Club. Members of the Plumtree Farmers' Association also visited the section.

A series of articles on culling of poultry were written and published by the *Rhodesian Farmer*. Sixty-two farms were visited during the year. A number of lectures was also given to various clubs and associations. Three successful shows were held during the year at Bulawayo, Gwelo, and judging was done at the Gwelo show.

Three hundred day-old chickens were imported from the Union to serve as foundation stock for future breeding.

General.—The Officer-in-Charge attended several Farmers' Association meetings and gave talks on various subjects. A comprehensive exhibit of the Division of Agriculture was staged at the Royal Show and included a section featuring the activities of the Station.

As in the past, the station was visited by a large number of farmers and by research workers from neighbouring countries.

SABI VALLEY EXPERIMENT STATION

First-year results at the Sabi Station were more impressive than those of this second year. This is thought to be due largely to weather. A rainfall of 28.69 inches during the season was approximately double expectations. In addition to the physical effects of flooding and waterlogging soils, there was the delaying effect of not being able to get on lands for preparation or seeding, and the effects of disease promoted by long periods of warm, damp weather.

High flood levels in the Sabi River so damaged the pumping station that it had to be practically rebuilt. Winds accompanying late rains in March did a lot of damage to experimental crops. Periods between rains seem just a little longer than most crops could go without irrigating, and consequently several times heavy rains fell on the heels of an irrigation, with unpleasant effects on crops.

On the credit side of the ledger, however, the physical plant is nearly complete. Six family dwelling units are complete, with the combined single men's quarters and guest house well under way. The power planter and farm equipment shelter are in course of erection. A poultry shelter and a farm shelter have been finished, and the service building is two-third complete. The pumping plant has been rebuilt and strengthened. The Mopani Farm is almost finished, and crops are going into the upper end of the lands. The Staff position has improved. Nearly a full complement of the personnel allowed for at present is on duty.

Field Crops

Maize.—The best yield recorded from any single plot this year was 27.9 bags per acre, with yields ranging downwards to under 3 bags per acre. Observations already indicate the tremendous importance of maintaining soil structure and keeping up the internal drainage of the Acacia soils, especially for crops such as maize. Green manure appears to be one answer; structural, chemical, and soil physical studies must be given a paramount role in research in the coming seasons.

Research on varieties this past year indicates that double hybrid N3 x A5 x T4 x M9 is far and away the best of any material so far planted at the Station, and that the best time for planting maize was through September and October into early November. Evidence is not conclusive but indicates that although yields are no better from maize planted on ridges as compared with maize planted flat, water consumption is lower.

Inbred lines from Krug are through the third generation, and seed has been planted for the fourth generation. First Sabi hybrid seed may be ready for test planting in October of 1954. Open pollinated seed of Krug is being bulked for top-cross testing. Sahara open pollinated has done so well that inbreeding in that variety will start during the current season. The development of a synthetic inbred of M3149 carrying streak resistance from Peruvian maize is being attempted.

Alfalfa.—This crop still looks exceedingly promising. Seed for variety testing has become available, and plots are under observation. Some seed of Hunters River from certified Australian stock has been produced at the Sabi Station, but yields will not be high until better pollination is assured by intensive stocking with bees. Alfalfa rust continues to cause losses in the hay crop.

Losses may also be expected from the summer rains, either through direct damage or by interfering with harvesting. Even hay well packed and under shelter spoiled all the way through during the hot wet weather of the last rainy season.

Cotton.—Yields were nowhere near as high this year as last, probably because of long-delayed planting and unfavourable early growing weather. Highest yield was 1,361 pounds, lowest only 88 pounds of seed cotton per acre. Some of the experimental plantings were replanted 2 and 3 times, some were lost entirely. Both fertility studies and moisture studies produced inconclusive results, but a variety test with seed from Gatooma, Uganda and South Africa showed that the Gatooma seed produced the best yield at the Station.

Sorghum.—Of a number of sorghums tried, Caprock, Early Hegari and Dwarf Managil were the best yielders. Sorghum trials will continue.

Fibres Other than Cotton.—Egyptian kenaf has been the only promising fibre plant so far found, and selection stocks will be maintained.

Wheat.—Of a number of varieties supplied from Matopos and collected at the Nyanyadzi Native Irrigation Scheme, Puse 4 has been outstanding, with Kenya Governor running it a close second. All others were not only much slower maturing, but far lower in production. All summer wheat seedings were lost on account of waterlogged lands. No observations are at hand for the summer varieties, but rust appears to be the worst enemy of the winter wheats.

Rice.—Forty varieties have been grown in a small paddy to keep up seed stocks. No intensive research programme is planned for this crop for some time, since it is thought unlikely that it can become important in the Valley until there is promise of irrigation water from behind storage dams.

Potatoes.—Potatoes at the Station this year have not been good, although a superb crop was reaped nearby from imported seed. The station seed came from a local source, and lifting was delayed by rains in the highlands, so that the

new seed planted late gave very poor germination. This points to the need for an assured source of seed ready to grow, if potatoes are to amount to much as a Valley crop.

Fruit.—Bananas. A quarter-acre of Dwarf Cavendish bananas were put in at the Acacia Farm for observation. Except for a setback due to light frost, they are doing well.

Citrus: Rough lemon root stocks at the Station have been budded to grapefruit from 5 sources, 4 types of orange, and 1 of smooth lemon.

Dates: The seedlings continue to grow. It will be several years before the trees bloom.

Miscellaneous.—Sesbania: A method of hot-water scarification has been developed which considerably improves the prospects for this green manure crop.

Croteleria: The fine-stemmed variety known as "intermedia" continues under test, in comparison with the standard sunn hemp (junces).

Sweet potatoes, edible canna, cassava and dwarf castor beans are all so unpromising that no more work is planned for them in the near future.

Peanuts: No planting was possible this past season on account of weather.

Napier Grass: The material originally obtained from a local source proved to be so mixed that although it did very well, it was eradicated. New plantings of carefully identified stocks have been made.

Sugar Cane: This crop in small test plantings has done very well at the Sabi Station.

Seed Flax: Seed of 4 varieties has been bulked up from very small lots imported a year ago, and variety testing will start next year.

Plant Selection and Breeding.—One of the most conspicuous needs of the Sabi Scheme is adapted seed. Nearly everything planted shows lack of adaptation to the Sabi irrigated environment. It will be necessary to produce seed for nearly any crop recommended for the Valley, at the Sabi Station, by (1) a programme of selection from existing stocks, and (2) an intensive and long-continued effort in breeding, hybridization and selection. Maize breeding is under way at the Station: it needs to be expanded. Wheat selection is under way on a small scale; breeding and selection need to be expanded tremendously if wheat is to become as important a Valley crop as it could be.

Livestock

Dairy Cattle.—A small herd of grade Jerseys has been established at the Station and has done very well indeed. Production from the cows has been good, their health excellent and condition outstanding. There has been no indication of any ill effects from hot weather. The only feed used for the dairy herd has been local summer pasture, and alfalfa hay with a little maize from the Station experimental plots.

Poultry.—A poultry flock from chicks obtained from the Government hatchery at Gwebi has been maintained on two systems of laying management. One was a small pen, deep litter, no range system; the other was a wire-cage battery. Commercial mash feeds and chopped green alfalfa were fed. Better production came from the pen birds in deep litter than from the cage birds. The present flock of pullets just coming into laying will be used to test farm-produced feeds against commercial feed, with 2 types of pen management.

Technical Research

The Use of Siphons.—In co-operation with the Goodyear Company, a curved rubber siphon for transferring irrigation waters from a raised canal to the fields has been produced. It is satisfactory in all ways except length of life — those under tent do not appear to last much over 15 months in constant use. Plastic siphons have recently been put under test at the Station. They are lighter than the rubber, but more awkward to use. Erosion around the delivery point of the siphons has been controlled by the simple expedient of putting a wet burlap sack down and running the water on to and over that.

Laboratory and Soil Chemistry Studies.—Equipment and supplies have nearly all been received, and facilities are now adequate for the conduct of planned research on plant and soil samples. A number of plots on the Acacia lands have been examined in some detail, and others have been laid out and put in where soil reactions may be studied with proper precision.

Soil Management.—As indicated earlier, the problem of soil management has emerged as one of the paramount subjects for study at the Sabi Station. Other aspects of the general problem of soil management which are receiving attention and to which increased effort must be directed are soil moisture studies, water use and its measurement and the overall matter of drainage. This latter is of fundamental importance, and even on the acacia soils drainage studies have been found to be necessary.

The Sabi soils may be said to be, in general, sandy clays, with poor inherent physical characteristics. Cultural methods may be expected to do a lot to modify them for good or bad. Serious degradation of structure and impeded percolation of water has already been noted on some of the mismanaged experimental plots. Methods to recover and improve soil structure with use are being investigated.

GAME SECTION

The Game Section, formed under the Entomological Branch in 1952, was transferred to Head Office in April, 1953.

Further useful information on game distribution was collected during visits to the Gwanda, Sebungwe, Wankie, Lomagundi, Mtoko and Inyanga districts.

The compilation of essential statistics on licences issued, vermin destroyed, importation of ammunition and firearms and other relevant matters has proceeded and some interesting results obtained.

An outbreak of foot and mouth disease in the Fort Victoria Lowveld considerably restricted hunting in the Nuanetsi district, and as a consequence a large number of applications was received from members of the public for permits to shoot in Tsetse Fly Control Areas.

Some work has been done to consolidate existing legislation and in the drafting of new legislation. The Game Officer will submit, in due course, recommendations on future policy for the conservation and utilization of wild animals and fish, together with a draft of proposed new legislation.

The Vermin Unit did not operate during the year because of difficulties encountered in filling the vacant post of vermin ranger.

The Game Officer will attend the International Conference on the protection of Fauna and Flora in Africa in October this year, and will also visit Tanganyika for the purpose of studying the methods and organization of the Game Department in that territory.

CHEMISTRY

General

The year under review showed very marked increases in the number of samples received and the amount of work done. So spectacular were these increases that the staff, brought fully up to strength and regarded as adequate, has barely been able to breast the flood. A further increase, which can be confidently anticipated, will mean that the work simply cannot be accommodated unless the staff is augmented or apparatus for mass analysis is brought in from America. As it was, a system hitherto not practised here whereby individual workers analyse a particular nutrient and a Senior Officer is responsible for the reports, was found necessary to deal with soil analysis. The system has obvious advantages but robs the work of much of its interest and the individual chemist of initiative and experience.

A notable and momentous change took place during the year as a result of research and accumulated evidence and experience. The branch has critical levels for phosphate and potash and considerable information on the availability of soil nitrogen, which together have revolutionized our methods of fertilizer recommendation. A great deal more work is necessary to establish all essential data on a completely reliable foundation, and this work is continuing intensively.

The Branch played a useful role at two symposia, by analysing, with scientific dispassion, the part which grass ley can play in soil fertility. The discussions were mainly abortive. The attitude of the Branch, on this and many other matters pertaining to the soil, is that intensive research should precede any widespread extension campaign.

The Soil Survey Section had a satisfactory year in that the Agro-Economic Survey was completed, on the ground, and the East Bank of the Sabi was surveyed in detail for the initial requirements of the Pilot Scheme. During the progress of the Sabi Survey five soil surveyors received training: four of them had no previous experience of field work.

The Pasture Research Section, strengthened by the addition of a technical assistant, analysed an extraordinarily large number of samples. The numbers which can be done in the future will be rationed and the duties of the responsible chemist will be more clearly defined. Closer touch is to be maintained with the research stations and closer participation in research projects.

The Fertilizer, Farm Feeds, Seeds and Remedies Act, 1952, became law during the year, and the regulations under it were promulgated. The Branch has continued, because of its experience, largely to administer the Act, but this function should be taken over gradually by the registering officer and the Secretariat.

Various talks on soils and fertilizers were given during the year to farmers' and other associations. Several officers attended the meeting of the South African Association for the Advancement of Science in Bulawayo.

Although a good deal of research work, other than that directly concerned with the establishment of fertility criteria, was done during the year, it is to be regretted that little progress was made in the trace element survey.

Laboratory Analytical Work

The classification of samples dealt with is as follows:—

Soils	1,885
Manures and Fertilizers	94
Farm Feeds	146
Waters	306
Vegetable Products	107
Limes and Limestones	14
Toxicological	444
Miscellaneous	83
Meats and Bloods	50
Soil Survey	198
Investigatory and Research	868
Pasture Research	1,811
Total	6,006

In addition, 210 litres of standard iodine solution were prepared for the Veterinary Department and 29 litres of caustic soda solution for the Dairy Branch.

The list shows an overall increase of 84% over the previous year's. At the end of the period many samples were still awaiting examination. The major increases are shown in soils, investigatory work and research and pasture research.

The increase in soil samples has coincided with improvements in technique, involving more detailed and exact analysis, and much further time has been taken up in interviews with the farmers bringing in the samples.

In toxicological work many poisons other than the traditional arsenic are being investigated.

In spite of unavoidable delays throughout the year the customary friendly relations between farmers and the Chemistry Branch were well maintained.

Soils for Advisory Work.—The sharp increases noted in this group, while general, were nevertheless most marked with respect to tobacco soils. As usual, tobacco soils included many more suitable for general crops. Fertilizer recommendations for tobacco were given usually in the form of straights or, where specially desired, as standard mixtures.

Some of the soils and pit descriptions in connection with small-scale irrigation schemes were very far from satisfactory. Next year it is hoped to detail a senior soil survey officer to examine these schemes *"in situ"* and give them the detailed and expert examination they deserve.

Manures and Fertilizers.—The large numbers of samples taken under the new Fertilizers, Farm Feeds, Seeds and Remedies Act will be reflected in next year's report. A great deal of work has been done on checking the composition of various guanos and assisting their registered manufacturers to comply with the Act.

Farm Feeds.—Apart from samples taken under the Act, most of those received were from manufacturers who required the analyses for registration purposes.

Waters.—A large proportion of these samples were from the Ngezi Dam for silt, and many other were in connection with seed beds. In future years as the result of agreement the Hydrographic Branch will submit fewer samples during the winter months.

Vegetable Products.—Although the numbers have dropped slightly, the material submitted has added valuable data to our records. The samples submitted by the Agricultural Experiment Station are included under this head.

Limes and Limestones.—These samples included some from farm deposits and some from sellers of agricultural lime which became subject to registration for the first time under the new Act.

Toxicology.—This figure includes specimens for identification of poisons and both arsenical and organic dips. Of the poison samples, 178 were positive and 202 negative. It is notable that to-day the Veterinary Department is concerning itself with a wider range of poisons than arsenic, involving the Branch in more detailed analyses. The pig, in death, continued to be a disappointment from the analyst's point of view, even strong post mortem indications failing to receive confirmation of arsenical poisoning. Of the 64 dips submitted, 46 were organic. The longer and more complex test of organic fluids cannot, as is the case with arsenical dips, be done in the field.

Miscellaneous.—Among the necessarily heterogeneous samples under this head were oils, salt, brine, ox gall, thermometers for standardizing and samples of wood and floor blocks.

Meat and Bloods.—Meats were analysed from the research stations to provide data for feeding experiments, and bloods were done for phosphate and chlorine: some of the latter were unsuitable because of prior clotting.

Soil Survey

During the year the Survey Staff was increased from three to six, the winding-up of the Tobacco Pest Control Research Scheme providentially releasing the necessary accommodation at the most opportune moment. The soil map and report of the Sebungwe area were completed, as were reports on the reconnaissance of the Zambesi Valley.

The most intensive detailed survey yet undertaken — that of the East Bank of the Sabi in the area of the initial stage of the Pilot Scheme — was successfully completed, in spite of different terrain and the necessity for training a proportionately large number of soil chemists new to field work. The senior field chemist of the Sabi party, with the Chief Chemist, examined some of the irrigated soils of the Sabi Experiment Station which appeared to be declining in structure and in productivity.

Work in connection with the Agro-Economic survey, which was mainly confined to Matabeleland and the Midlands, included detailed soil work on the Rhodes Matopos Estate.

Smaller tasks included visits to the Coloured Ex-Servicemen's Irrigation Scheme at Chipoli and the apple and other orchards at Inyanga.

Research and Investigatory Work

Most of the work was directed towards the establishment of reliable criteria for the assessment of soil fertility. Considerable progress was made in the correlation of crop response with analytical data as well as a corresponding improvement in laboratory techniques and the methods of predicting manurial requirements. There is need, dependent to some extent on suitable experimental soils, for more work on the assessment of optimum fertilizer dressings. It is of interest to note that very wide variations have been found in nutrient status even among soils of the same type, and these variations may be intensified by the accumulated effects of fertilizer applications.

One of the major advances, apart from criteria for phosphate and potash, is that the availability of soil nitrogen has been found to be fairly constant and is measurable. A study of many past field records has given interesting figures which are consistent, "*mutatis mutandis*", with those obtained in America and other parts of the world and which have enabled a nitrogen availability factor to be incor-

porated in our system of measuring nutrient requirements. Very intensive further work on this subject is already in hand.

Various other investigations concerned with the mineral status of Rhodesian soils, and with the amounts of nutrients removed by different crops and cropping systems, have continued and have produced information of considerable interest and value. The trace elements survey, samples for which have been collected from all over the country, has not been started analytically for lack of staff and time.

In collaboration with the Council of Scientific and Industrial Research, Pretoria, clay minerals from a number of different soil types have been identified.

Very detailed investigations are proceeding on green manuring and crop rotations, nutrition of tea, nitrogen in rainwater, fertility under grass leys, the manuring of sugar cane and many other related subjects.

Pasture Research

The bulk of the large number of samples came from Grasslands (1,015) and Henderson (668), while the Matopos' samples analysed numbered 94, and Gwebi's 34. It is considered that if the large number of protein estimations could be carried out at the Stations, a good deal of real research could be undertaken. Apparatus for such work should not cost much more than £200, and a technical assistant could do the work with some guidance from here. Towards the end of the period under review the chemist carrying out pasture research identified himself more closely with the various stations and with their research.

Publications

The following scientific papers by members of the staff appeared in various technical and farming journals during the year:—

J. Goldsmith Thompson: Preliminary Note on a Suggested New Method for Exchangeable Bases in Calcareous Soils, *The Journal of Soil Science,* Vol. 4, July, 1953, No. 2.

B. S. Ellis: The Soil, *Rhodesia Agricultural Journal,* Vol. 50, No. 1, Jan.-Feb., 1953.

B. S. Ellis, R. G. Thomas and J. G. Thomson: The Soils of the Lower Sabi Valley, *Rhodesia Agricultural Journal,* Vol. 50, No. 2, Mar.-Apri., 1953.

B. S. Ellis: Soil Analyses and Fertilizer Recommendations, *The Rhodesia Farmer,* 16th September, 1953.

The Chief Chemist also formed one of a Committee producing a series of papers in the *Rhodesia Agricultural Journal* on "Natural Water and its use in Southern Rhodesia".

ENTOMOLOGY

The separation of the Tsetse Fly Operations from the Branch has resulted in a certain loss of elasticity but will provide more secure opportunities for fixing attention on the requirements of agricultural entomology once a sufficient staff has been built up. The Game Section, out of place in entomology once the Tsetse Fly Operations had been divorced from it, was placed under the direct control of the Director.

Insect Records

The International Red Locust Control Service has had a successful year and the situation in the known outbreak areas of the Red Locust appears to be satisfactory. Preparations are well in hand for the coming season.

Grasshoppers, which had apparently reached the peak of a cycle of development in Southern Rhodesia last year, were this year no more than normally troublesome. There was one report of Army Worm, which was found to be false.

Other pests of cereals and grasses included the Maize Stalk Borer, which was more plentiful than usual on native-grown cereals. Its incidence was widespread on European maize crops, but infestation was not of unusual severity. Early in the growing season signs of attack by an insect presumed to be the Maize Stalk Borer were noticed in Napier fodder grown on contour lines in maize and other lands at the Henderson Research Station. As the intention was to use cane instead of roots for further plantings in the following season, the insect's progress was studied during the winter. It was provisionally concluded that the

practice of growing Napier fodder near maize would be fraught with danger to the maize unless stalks were cut and suitably disposed of, such as by feeding or ensilage, some time during the winter or early spring months. Studies are being continued. The identity of the insect needs confirmation.

The Corn Earworm or American Bellworm did considerable damage to ripening maize and sorghum in the autumn, as well as to cotton bolls. On one farm it was successfully controlled over a few acres of sorghum by a single application of a mixture of equal parts of two dusts containing 10% DDT and 3% BHC, respectively, at the rate of 12½lb. of the mixture per acre.

Some cutworm damage in maize lands was shown to be due to weedy preplanting conditions, which are known to contribute to the best condition for cutworm outbreaks.

The Root Knot Eelworm was recorded with its customary frequency, particularly from solanaceous crops and a wide variety of vegetables. The Potato Tuber Moth was active on the potato crop in the field and in storage, but owing to standard practices was less so in tobacco.

An outbreak of leaf curl in tobacco was investigated, and it emerged that one or more species of whitefly of the Genus *Bemisia* which were breeding in cassava may be identical with what we know as the Tobacco Whitefly, or may be capable of transmitting leaf curl from tobacco or possibly other plants, to tobacco.

Early planted sunn hemp normally suffers severely from the attack by Sunnhemp Beetles if that crop has been planted early in the vicinity during the immediately preceding years, but the pests may be avoided by late planting. After several seasons of late plant at the Salisbury Experimental Station, an experimental early crop was planted and, as expected, no Sunnhemp Beetles were subsequently found on it. This suggests that several seasons of late planting had reduced the local population of these beetles to the obscurity manifested by them before the introduction of sunn hemp into our rotations.

The most commonly recorded pests of other leguminous crops were the Bean Stem Maggot and the Root Knot Eelworm.

Extensive damage to young cotton plants was caused by one of the common snout beetles which usually attack maize and other crops when these are young. They were readily controlled by means of DDT dust. A long-horned beetle damaged cotton at Gatooma by ringing the terminal shoots, and the bollworms, especially the American Bollworm, were responsible for considerable destruction throughout the country. The Dusky Cotton Stainer was found in large numbers in the seedheads of Kenaf (Hibiscus cannabinus L.) at Salisbury, and were experimentally reduced by means of a fog containing dieldrin.

Scale insects were responsible for most of the inquiries received regarding pests of citrus and deciduous fruit trees.

There were fewer reports of fruit flies and melon flies "stinging" fruit and cucurbits. As the Diptera, to which these and all other true flies belong, appear to be foremost among insects to develop resistance to modern insecticides, the increasing use of parathion baits for the control of fruit fly and melon fly is not being recommended officially until more is known, as it may lead to the development of resistance by these insects not only to parathion but also to the standard lead arsenate or sodium fluosilicate baits.

Several borers in timber were reported, but none was of any unusual species. Some incidental records of insects attacking forest and ornamental trees were noted.

Common garden pests such as the Gladiolus Fly, bush locusts and miscellaneous bugs, beetles and caterpillars were reported in more or less accustomed numbers. What is believed to be the Narcissus Eelworm was found in daffodils and has not been previously noted here.

A factory's store of tobacco infested with the Stored Tobacco Beetle was successfully fumigated with methyl bromide.

Investigations

In exploratory tests with chlordane applied in emulsion form at the planting sites of seeds of maize, pumpkin, carrot, French bean, and transplants of cabbage, before planting or to the young plants, or both, no phytotoxic effects or tainting

could be detected. The growth of carrots was noticeably better in the treated plots, probably because of protection given to the young plants.

Inconclusive results were obtained when the systemic insecticide B.F.P.O. at a concentration of 0.1% active ingredient was applied at the rate of ½ pint per square foot to the soil with the view to controlling the Cabbage Leaf Miner. No control of mealy bug on a hibiscus hedge was obtained with a single foliage spray application of the same material at the same dilution.

Parathion and a white oil emulsion at the normal practical concentrations were compared in tests on the Mango Scale. Both were effective, but the degree of control effected by parathion a month after spraying was superior to that shown by the oil.

Extensive tests were made of the protection of grain and pulses by means of residual applications of DDT and BHC on a cost-to-cost comparison. As a result, our preference for DDT wettable powder was confirmed, but the amounts recommended have been lowered.

The protection of exhibition ears of maize by a deposit of DDT from solution was studied.

Taxonomy

About 150 species of insects were identified for the Branch by specialists, mostly through the services of the Commonwealth Institute of Entomology, London, and the British Museum (Natural History). They included several specimens new to science.

Apart from identifications arising from over 500 miscellaneous queries, about 115 identifications were made by the Branch for other scientific bodies and many for the Branch's own collection. About a dozen named Orthoptera were presented to the Queen Victoria Museum, Salisbury.

Advisory Service

The number of recorded inquiries regarding insect and other pests increased by 6% to 531, and many others were unrecorded. Most of these inquiries related to pests of farm and garden. Exhibits were placed on the five-day Agricultural Shows at Salisbury and Bulawayo and supervised by Professional Officers of the Branch, and an officer was in attendance for a week at the Divisional exhibit on the Rhodes Centenary Exhibition, Bulawayo.

In addition to the 1,715 and 24 regulatory visits made respectively on tobacco pest inspection and nursery duties, and to miscellaneous visits on investigations, 26 advisory visits to farms and other premises were made.

Twelve lectures, mostly to students of the Gwebi Agricultural College, and one broadcast talk, were delivered.

Publications, mostly advisory, included:—

Anon: Some Aspects of Tobacco Pest Regulations, October, *Farmers' Weekly.*

M. C. Mossop: Bushfuls of Grasshoppers, *Rhodesian Farmer,* December.

Anon: Army Worm Danger, *Rhodesian Farmer,* March.

G. F. Cockbill: Investigations on the Control of Insect Pests of Stored Grains and Pulses, *Rhodesian Agricultural Journal,* July-August.

G. F. Cockbill: A late Grasshopper Pest, *Rhodesian Farmer,* April.

M. C. Mossop: Insect Control in the Tobacco "Off Season", *Tobacco Journal,* September.

A leaflet on "Some Aspects of Tobacco Pest Regulations" was issued to farmers.

Plant Regulatory Service

The plant regulatory service includes the administration of the Plant Protection Act, 1942, and its various regulations. A Plant Regulatory Board is called upon to discuss matters of importance to other Branches or Departments. Co-operation with these Branches, as also with other countries, in regard to plant interchange, is considerable.

New plant import regulations included conditions under which Virginia type tobacco could be consigned from Northern Rhodesia to the tobacco auction floors in Salisbury without the authority of a permit, and exclusion of garden pea seed from the Union of South Africa unless in officially sealed containers.

The number of packages of plants, fruit, etc., subject to examination on entering the country was 761,740, an increase of nearly 17% over the number for the previous twelve months. About 350 consignments of fruit, seeds and plants were destroyed, sorted or returned to the country of origin for the protection of our agriculture. Many of them were no larger than uncertified packets of pea seed and tomato seed. Our organization, however, could not prevent the entry of a normally air-borne rust of maize, Puccinia polysora, which has spread across Africa in very recent years.

Special permits to import plants decreased by 35% to 1,014, the main reason for the reduction being the removal of most bulbs, tubers, etc., from the permit list. Annual permits issued to selected nurserymen in the Union of South Africa to introduce their stock into Southern Rhodesia remained unchanged at 102.

Thirty nurseries were registered during the year. In 24 inspections, slight infestation by Red Scale was found in seven, resulting in two quarantines.

The number of tobacco removal licences issued for 1953 was 3,110, being over 4% lower than the number for 1952. The number of inspections was 1,715, an increase of 108%, but falling short of the accepted minimum target of two inspections of each premises per annum.

Three prosecutions were made in respect of unauthorized retention of tobacco plants or seedlings, each one resulting in a conviction. The Stored Tobacco Beetle was found in one sample room and two storage premises, and suitable action was taken.

By arrangement with the Portuguese authorities, three visits were made to Beira by Entomologists of the Branch, who inspected the sheds used for Rhodesian tobacco in transit for overseas, made recommendations for their precautionary treatment, and discussed the treatment of ships' holds.

Three certificates of partial exemption from the regulations in regard to destruction of cotton plants were issued. There was one prosecution in terms of these regulations; it resulted in a conviction.

Certificates of freedom of plant material from pests and diseases numbered 69, as against 112 in the previous twelve months.

Small amounts of beeswax were admitted from overseas, but a parcel of honey was destroyed. Regulations in this respect do not apply to neighbouring countries.

Miscellaneous

There are signs of a greater interest being taken in beekeeping, in spite of the apparent demise of the two beekeepers' associations. There is, however, no specialized apiculturist in the Branch. Interest has been shown in the possibility of exploiting the vast potential supplies of beeswax discarded piecemeal in mouthful quantities by natives in their kraals in the Zambesi Valley and elsewhere.

TSETSE FLY OPERATIONS

The branch was formed in April, 1952, with the duty of intensifying all anti-tsetse measures on a National basis and of co-ordinating, as far as possible, the work of other Departments in the control of tsetse and animal trypanosomiasis.

The movement of several thousand African families from the European areas to the Special Native Areas, in terms of the Land Apportionment Act, has made it a matter of urgent national importance that more land be reclaimed for Native occupation. The problem will, inevitably, develop in importance in view of the rapid increase in the African population, which is expected to double every 25 years.

All authorized professional and field posts were filled.

Urungwe.—In the Urungwe district the emergency measures started last year were completed. These included completion of the game fences, stricter control of the Native hunters and intensification of game destruction, road building, and the reorganization of the area under three European Rangers. Tsetse surveys have been carried out by the Entomologist in charge of the area and have greatly increased our knowledge of the distribution of both *G. morsitans* and *G. pallidpes*.

All these measures are beginning to show concrete results. The number of tsetse caught at traffic control points on the eastern fence are decreasing, also the number of "odd" flies being caught in the eastern half of the reserve.

The number of farms on the Karoi Block infested with trypanosomiasis increased from sixteen in September, 1952, to twenty-five in April, 1953. Most of this increase occurred during and just after the rains. Subsequently two more farms became infested, making a total of 27. The incidence of new and recurrent infections recorded each month reached a peak of 130 in March, but, as a result of the intensification of control measures including treatment of all infected stock by the Veterinary Department, the number has steadily dropped to six in September. No farms east of the main Chirundu road became infected. The position at the end of the year was very encouraging.

Based on the result of detailed ecological and tsetse surveys carried out by the Entomologist, it has been decided to treat one of the known high concentration areas west of the Reserve with 4% gamma BHC applied in smoke form from Aircraft.

Mtoko.—In the Mtoko district surveys have indicated a slight westward spread of the fly belt towards the Mtoko Native Reserve. The density of tsetse throughout the whole area is extremely low, no concentrations having been located. Difficulty has been experienced in obtaining voluntary Native hunters, and at the end of the year only 155 were in the field instead of the anticipated 200. These hunters are inexperienced and atrocious marksmen. Game is fairly numerous and evenly distributed throughout the area. All the cattle in the Mkota reserve, except some 200 head, died during the year. The remainder were slaughtered and compensation paid. There has been a steady increase in the incidence of animal trypanosomiasis in the Chikwizo Reserve, and the Native owners have been advised to sell their cattle before their losses become serious. The spread of the disease in the Mtoko Reserve appears to have been checked.

In the adjoining Inyanga North Reserve about a 10% infection occurs at two concentration areas in the extreme north bordering Portuguese East Africa. Fly surveys have failed to pick up any tsetse. The removal of these cattle away from the source of infection is under consideration.

Sebungwe.—In the Sebungwe district the movement of Natives with stock from the European area to the new special native areas, marginal to tsetse-infested country, has continued. There has been a very considerable improvement in the trypanosomiasis position, although the number of deaths from other causes remains high. Tsetse surveys carried out by an Entomologist have indicated a possible slight seasonal increase in tsetse on the Mzola river, and special arrangements have had to be made for the control of native stock movements. Settlement of natives without stock, based on boreholes, is being organized on the eastern side of the fly belt between Dandana Pan and the Rutope River to act as a fly barrier.

The fly and trypanosomiasis position on the western edge of this fly belt in the Wankie district is somewhat obscure, as the limits of *G. pallidpes* are not accurately known. Cases of trypanosomiasis among native stock have occurred. Many of these cattle have been newly introduced into the area.

Other Areas.—For the first time, probably since 1912, no records of tsetse have been made in the Darwin district. The numbers of native stock are increasing in all the areas reclaimed. Cattle in the Kandeya Reserve now number about 17,000, compared with 300 when the operations commenced in 1930. No cases of trypanosomiasis have been reported.

No tsetse or cases of trypanosomiasis were recorded from the Hartley district, where resettlement of the Sanyati Reserve is nearing completion.

Again no tsetse have been recorded north of the Umfuli River in the south-western portion of the Lomagundi district, and the few head of newly introduced stock have remained free from trypanosomiasis.

There is little change to report from the area of operations north of the escarpment in the Lomagundi district. A slight infestation of tsetse still exists east of the Hunyani River. Heavy fly densities have been recorded near the Angwa River, which forms the boundary of the control area. There are no cattle north of the escarpment west of the Kadzi River.

A tsetse survey of the area lying north of the Doma Settlement was repeated. No tsetse were found South of the escarpment.

On the Eastern border (Chipinga district) the border clearings were maintained by fire and slashing back of regeneration. Slight additions to the clearings

were made. The incidence of trypanosomiasis on the European farms was again very low, only 18 cases being recorded. Most cases, 27, occurred amongst native stock in the Gwenzi Native Purchase Area.

The position in the lower Sabi Valley area has deteriorated. One *G. pallidipes* was caught on the Sabi River at the Chibirira Falls. *G. morsitans* is found over a considerable area adjoining Portuguese East Africa, from which all cattle were removed several years ago. There has been an increase in animal trypanosomiasis at Mwangezi and Muumbi dips.

BOTANY AND PLANT PATHOLOGY

Botany

Herbarium.—The rate of new accession was maintained, a total of 4,735 being entered. 1,547 of these were for other Government Departments. The Brain collection was taken over from the Queen Victoria Museum. Another important collection received was that of the Rev. R. A. S. Martineau which formed the basis of his recently published book "Rhodesian Wild Flowers".

Many new records were obtained, most of which are still awaiting confirmation. One new species and one new variety of *Erica* have been written up for publication.

A great deal of material was sent abroad for critical study by specialists.

The first three parts of the "Revised List of Grasses of Southern Rhodesia" have been completed by Miss Sturgeon, and Part I appeared in the July-August issue of the *Rhodesian Agricultural Journal*. This work will be of great value to farmers and agricultural officers generally.

The Botanical Dictionary of Native Plant Names is now being printed and should be published very shortly.

Economic Botany.—Poisonous Plants: Cases of cattle poisoning due to *Datura tatula, Ranunculas multifidus* and *Senecio latifolius* were investigated.

Forage Plants: Exotic and indigenous legumes under investigation at the Henderson Research Station were studied and named.

Medicinal Plants: The Senior Botanist has collaborated with Dr. M. Gelfand in his work on native medicinal plants.

Weeds: Hormone weed killers have continued to give good control of water hyacinth in the Makabusi and Hunyani Rivers. Infestation in the former stream has been reduced to a very low level. The situation in Lake MacIlwaine is not so satisfactory due to the physical difficulty of reaching the weed and to lack of finance to cover materials and labour. Increasing use is being made by farmers and gardeners of hormone weed killers and has led to numerous inquiries for advice on the subject.

National Botanic Gardens.—No development has been possible, the funds provided being only sufficient for routine maintenance.

Plant Pathology

Laboratory.—804 specimens were received — a record figure. They included 31 diseases new to Southern Rhodesia, amongst which the following important records deserve special mention:—

Maize rust due to *Puccinia polysora* Underw. 33 p 226

Rice blast due to *Piricularia oryzae* Cav. 31 p 475

Vine and root rot of velvet bean due to *Phytophthora* sp. (probably P. *parasitics).* This disease appears to be on the increase in some districts.

Hollow stalk of tobacco caused by *Bacterium carotovarum.* First record of its occurrence on flue-cured varieties, previously found on fire-cured tobacco.

Crops

Tobacco.—Wildfire was again prevalent but did not cause appreciable damage. Spot necrosis hitherto ascribed to phosphate deficiency was widely reported mainly on heavy soils following long, wet spells. The first records of hollow stalk on flue-cured tobaco were associated with topping during rainy periods. Rosette and leaf curl viruses were more common than usual.

Potatoes.—The summer potato crop was devastated by the most severe and widespread epidemic of late blight (Phytophthora infestans) ever recorded in Southern Rhodesia. Only early plantings escaped damaging losses: the first from imported crop which was put in late was an almost total failure. The March-April irrigation crop was also attacked.

Most records of the fungus were identified as strain "D" (not strain "B", as erroneously reported in last year's annual report). The common strain "A" was also found.

Widespread leaf roll developed in irrigated crops grown from South African seed.

Maize.—The new rust disease due to *Puccinia polysora* was discovered in the Lomagundi district in early March. Subsequently, it was found in other localities including the Mazoe district and the Sabi Valley. Apart from the last-named area, where the rust was particularly severe on late-planted maize, no serious losses were reported.

Helminthosporium blight *(Helminthosporium turcicum)* was exceptionally severe in many maize-growing districts. The disease appeared earlier than usual and attacked both hybrid and open-pollinated varieties. Substantial losses due to this disease were reported.

Despite the wet season, no serious damage was occasioned by cob rotting diseases.

Research

Maize.—Considerable attention was given to foliage diseases using modified techniques for assessing visual damage. It is increasingly evident that maize leaf diseases are of more consequential importance than the cob-rotting diseases.

Sunn Hemp.—Studies on lodging due to *Colletotrichum curvatum* were continued. No resistance was found in the selections made last year. No evidence of seed-borne transmission of the disease has yet been discovered.

Velvet Beans.—A serious dieback affecting green manure crops of velvet bean on several farms in the Mazoe valley was reinvestigated and found to be caused by a species of *Phytophthora.* The fungus readily attacks germinating seeds and, as it is a soil-borne organism, the most promising line of control will be by the development of resistant varieties.

"Big Tree" Disease.—Two fungi were isolated from the black canker disease of boababs. One has been identified as a species of *Phomopsis.*

Deccan Hemp.—A stem break disease caused by *Botrytis cinerea* was investigated in experimental plantings of this fibre crop. Marked varietal differences in susceptibility were recorded.

Seed Testing

Laboratory.—707 samples were received and 1,482 tests made. 17 per cent. of all samples and 27.6 per cent. of the tobacco samples tested were below the authorized minimum.

Tobacco, maize and forage legumes formed the bulk of the samples examined. There was a big increase in the number of vegetable seed samples submitted following the introduction of official regulations.

The quality of tobacco seed as judged by germination capacity was substantially below that of the two previous years. Despite adverse weather conditions, seed maize was generally equal in quality to that of previous years.

Legislation.—The Seed Regulations under the Fertilizer, Farm Feeds, Seeds and Remedies Act, 1952, were promulgated on the 2nd April, 1953. Certain officers of the Department and all European members of the British South Africa Police have been gazetted as Seed Inspectors under the Act.

Two approved seed testing laboratories have been established by seed merchants in Salisbury, whilst the Tobacco Research Board is arranging to open a similar laboratory in 1954.

Research.—Sunn hemp seed was found to have a heavy contamination of moulds. Suitable seed disinfectants have been recommended.

The effect of time of harvesting upon the germination of tobacco seed was studied. Seed should not be collected before the "brown tip" stage of the capsule if it is to reach standard germination requirements.

Visibility tests on tobacco seed show that seed more than 4 or 5 years old is unlikely to satisfy regulation standards for germination. Similar tests with silver nitrate treated, treated and washed, and untreated tobacco seed reveal no deterioration in the seed after storage for 2 years.

Further investigations were made into the germination of local grass seed. Rhodes grass requires a lower temperature than is advised elsewhere.

New methods for assessing the amount of disease in germinating maize seed have been examined and a modified technique adopted for this purpose. A critical examination of the reaction of inbred and hybrid maize towards cob-rotting fungi was carried out, using various methods of inoculation. As a result, a simple technique which simulates natural infection has been standardized.

Seed Herbarium.—More than 1,600 specimens have now been collected. The Herbarium is proving of great value in identifying seeds for farmers and research officers.

Miscellaneous

A conference was convened in Salisbury during August to discuss the new rust disease of maize caused by *Puccinia polysora.* Delegates attended from the Union of South Africa, Southern and Northern Rhodesia and Nyasaland. The Chief Botanist and Plant Pathologist was asked to undertake the co-ordination of investigations and the distribution of information regarding this important disease throughout the territories concerned and with other African research centres working on the same problem.

Lectures were given at Gwebi College and to several Farmers' Associations. Exhibits were placed on the Salisbury and Bulawayo (Royal) Agricultural Shows.

The Chief Botanist and Plant Pathologist, Dr. J. C. F. Hopkins, retired during the year after guiding the work of the Branch since 1926.

Publications

In addition to advisory articles and notes in farming periodicals, the following publications were issued:—

H. Wild: "A Guide to the Flora of the Victoria Falls", a chapter in *The Victoria Falls Handbook.*

H. Wild: Tropical African Plants XXIII — *Aeschynomane inyangeusis* sp. nov. and A sphylla sp. nov. Kew Bulletin, Part I, 1953.

J. C. F. Hopkins and E. A. Riley: Bacterial leaf spot of *Nicandra physaloides Gaertu, Rhodesia Agricultural Journal,* November-December.

W. E. Kerr: Seed Legislation, *Rhodesia Agricultural Journal,* March-April.

H. Wild and G. H. Cooper: Mexican Clover (Richardie brasiliensis) as a Green Feed for Poultry. *Rhodesia Agricultural Journal,* July-August.

K. E. Sturgeon: A revised list of the Grasses of Southern Rhodesia, Part 1. *Rhodesia Agricultural Journal,* July-August.

Conclusion

A study of the foregoing report which has been prepared by the Heads of Stations and Branches shows that considerable expansion has taken place in the work of the Department. It also shows the tremendous range of work and the variety of problems facing the Department. In its work towards their solution, valuable co-operation and assistance, which is much appreciated, has been received from other Departments in the Division and many outside it. Finally, I wish to pay tribute to the enthusiasm and hard work of all members of the Department.

R. McCHLERY,
Director of Research and Specialist Services.